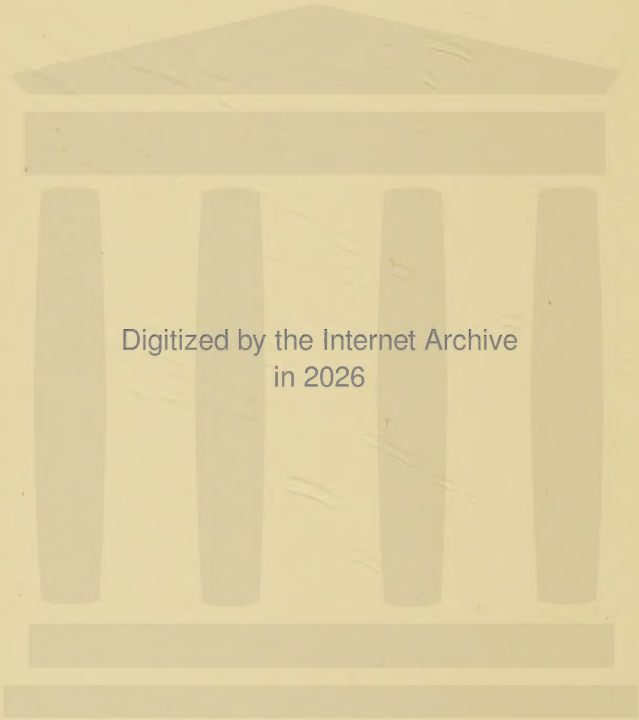
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THE MIND OF LEONARDO DA VINCI

LEONARDO DA VINCI, BY HIMSELF

THE MIND OF LEONARDO DA VINCI

EDWARD MacCURDY

Editor of *The Notebooks of Leonardo da Vinci*

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LIST OF ILLUSTRATIONS

1. LEONARDO DA VINCI, BY HIMSELF. *Royal Library, Turin* *Frontispiece*
Red chalk.

2. WAR MACHINE WITH SCYTHES AND ARMOURED CAR. *British Museum* *face p.* 26
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Above lower drawing on left: 'how the armoured car is arranged inside.'
Below same: 'it will need eight men to work it and make it turn and pursue the enemy.'
Below that on right: 'this is good to break through the ranks, but it must be followed up.'

3. BALLISTA. *Codice Atlantico, folio* 53, *verso b* *face p.* 38
'A Roman military engine resembling a huge cross-bow, which propelled large and heavy missiles by means of a tightly twisted rope or by violent movement of levers.' (*Chamber's Ency.*).
Text: 'The span of this ballista where the rope is fastened is 42 braccia; it is $1\frac{2}{3}$ braccia without the covering in the thickest part and $\frac{2}{3}$ braccio in the most slender. It is 14 braccia high, the shaft is 2 braccia wide and 40 long and it carries 100 lbs. of stone, and when it is on the road the shaft is low and the ballista is directed by the length of the shaft.'
Notes below the two drawings of parts of the engine on the left are:
'This is the form of the instrument when it is worked by a rope and its release is caused by the blow of the hammer upon the nut.'
'This produces the same effect as the instrument above except that it is released by the lever and it is noiseless.'

4. DRESS FOR TOURNAMENT. *Royal Library, Windsor* *face p.* 46
Black chalk.
Possibly made for troop of Scythians for the festa in January 1491, as referred to in MS. C of the Institut, folio 15

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8. STUDY OF FLYING MACHINE. *Manuscript B of the Institut de France, folio* 80, *recto* *face p.* 274
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'So for this reason I maintain that this is better than any other.'
Note below: 'Ladder to mount and descend; let it be 12 braccia high, and let the body from poop to prow be 20 braccia and five braccia in height, and let all the outer framework be of canes and linen.'

NOTE

I AM conscious of more than usual indebtedness to the researches of Dr. Müller-Walde, to Dr. Gerolamo Calvi's recent work on Leonardo's manuscripts, and to the invaluable series of the *Raccolta Vinciana*, which, under the editorship of Dr. Verga, has become the one indispensable mine of information for the student of Leonardo. For the labours of Dr. Richter, who first fared through the uncharted sea of the Leonardo manuscripts, all students must have a profound admiration, and mine only increases with time.

FOREWORD

Among unforgettable memories is that of a vista which once met my eyes while walking among the foothills of the Piedmontese Alps. We had struck westward from Gressoney St. Jean towards Chatillon, and the path beyond Brusson lay through woods until we reached the summit of the Col de Joux and there found ourselves confronted with a spectacle of extraordinary magnificence. It was about six o'clock. The air had the peculiar clearness which precedes sundown. Four thousand feet below lay Chatillon; beyond it, amid the flanking hills, the wide valley which takes its name from the city of Aosta led straight as an arrow to where some forty miles away, dwarfing the surrounding peaks, the mighty mass of Mont Blanc towered in lonely sovereignty, the eternal snows of its summit flushing crimson in the rays of the sun.

I remember how we lingered there reluctant to descend and leave a scene of such grandeur, conscious that although we had spent weeks at its base we had never before seen the mountain in a tithe of its majesty.

Would that it were possible to attain to some eyrie spot of vision, some Pisgah where should stand revealed the alp-like statue of the man whose measure of universality in mental gifts has no equal. Add the world of Shakespeare, called by Coleridge myriad-minded, to that of Bacon and the dualism of endeavour which was Leonardo's would have its parallel.

> 'But O I talk of things impossible
> And cast beyond the moon.'

There are no Pisgah sights! If you would see the vision you must follow him in the infinite toil which preceded achievement. 'Thou O God,' he says, 'dost sell unto us all good things at the price of labour.' Even then the vision is and must be circumscribed, for as genius approaches the universal the more difficult it is for it to be seen except in section. The necessary degree of specialization in exact

knowledge is so great that it is only by following one or at most very few furrows that the delving of research can meet with any reward of treasure. How then should it be possible to estimate the value of the work of one of whom it may be claimed that he took all knowledge as his province? Of whom the king at whose court and in whose service he passed the last three years of his life has left it on record that he did not believe that there had ever come into the world a man who had known so much! All that may be attempted is to examine as it were a few facets of the beryl. In the thousands of pages of his manuscripts he has left the mirror of his thoughts, and there his mind may be seen at work, moving among the phenomena of nature and the inherited knowledge of antiquity, trying all things, expounding all things, proving all things.

¶ PART ONE
FLORENCE TO 1483

FLORENCE TO 1483

For background the Tuscan hill-country, beloved of her artists. Summits castle-crowned or arid and bare. Sides broken by runnels and streams that grow in a night and loosen the soil of their banks and bear it foaming down to the Arno. Grey walls winding about the hillsides; gleam of white and silver of twisted olives; pinnacles of dark cypress cutting the air; murmur of bells of wandering goats. Where the valleys meet the slopes of the hills are *poderi* white and red walled, and all about the vines trail in the sun and everywhere in spring there is the radiance of the almond. On the tops of the lesser hills castles, campaniles, houses, timeless as the rocks, cluster together thickly and crown them with an abiding sense of man's antiquity. Thus Vinci – thus Anchiano a mile or more beyond it – villages perched high above Empoli, where the Arno slowly loosens her serpentine coils, nestling each in contentment among the wide folds of Monte Albano. At Anchiano Leonardo da Vinci was born in the year 1452, and there he lived in the years of childhood, and how much of the vista lives in the record of his life.

Son of a youthful notary, with four generations of notaries for paternal ancestors, illegitimate, but – as though nature wished to guard him against the disadvantages usually attaching to this fact – sole scion of the house for twenty-four years during the duration of two childless marriages of Ser Piero, after which the latter, marrying a third and then a fourth time, became possessed of nine sons and two daughters, the last being born nearly fifty-two years after Leonardo.

Of his mother we know nothing for certain, except that her name was Caterina and that she subsequently became the wife of a certain Accattabriga di Piero del Vacca of Vinci. Ser Piero of astonishing virility prospered in all his affairs, and from being a notary of Vinci rose to be notary to the Signoria of Florence, where he was living in 1469, and with him Leonardo, as is shown by a taxation return of that date.

Ser Piero had still also the house at Vinci, but already we may assume Leonardo had entered Verrocchio's studio, – and in so doing had passed into what was at that time the principal training school of Florentine artists.

How his father, who was a friend of Verrocchio, took some of his son's drawings to him to ask his opinion of them, and so brought it about that he was admitted as a pupil to his studio, is told with all vivacity by Vasari.

The precise date is a matter of inference, but in view of the fact that apprenticeship in the trade guilds of Florence commenced as a rule in the fourteenth year, and that Leonardo according to Vasari was placed with Verrocchio in his boyhood, we may assume that Herr Müller-Walde is substantially accurate in ascribing the event to the year 1466, when Leonardo had reached the age of fourteen.

Then commenced his intercourse with the art world of Florence; but in reading the account in his Treatise on Painting how Giotto's love of art first found expression, we may perhaps read something of his own first lessons, and we may also discern how the seeds of those wider interests of his life which separate him from the artists of his time had already been implanted in his mind by that same contact with nature in the Tuscan hill-country.

Certain it is that his earliest dated drawing, the landscape of 1473 in the Uffizi, has a definitely Tuscan character, and that the perception of the structure of the rocks shows something of the absorption of the scientist.

To the Tuscan follows the Florentine background. Florence of the Quattrocento! The Republic in transition! Liberties undermined first by the Albizzi, then more speciously and with greater completeness by the Medici; but as regards the sway of Cosimo, 'pater patriae,' and his grandson Il Magnifico such supremacy being the natural, the inevitable rule of the born master of statecraft, who must be supreme whatever the system.

But how many and divers the roads that opened to talent

in lieu of that astride which lay the ambitions of a dynasty! Florence had been in the forefront in classical learning since the days of Petrarch and Boccaccio, and the pursuit received new stimulus from the liberality of the Medici.

Science followed in its train, rich in knowledge thus revealed, adding new power in observation of processes. In art and letters the city of Giotto and Dante had lost nothing of the pre-eminence which they had established. To the naturalism of Giotto, as to that re-birth of naturalism in Masaccio's work in the Carmine, Leonardo has borne testimony in a passage of his manuscripts which serves to show with what acumen he surveyed the works of the earlier Florentine painters.

His own participation in the intellectual life of the city, commencing with the section of it which frequented Verrocchio's studio, extended with the continually widening scope of his studies. All Verrocchio's more important commissions were as a sculptor, and it is therefore natural to assume that the prominence given to sculpture in Vasari's account of Leonardo's activity after entering Verrocchio's studio had a close relation to fact:

'And he practised not one branch of art alone, but all those of which drawing formed a part, and having an intellect so divine and marvellous, and being an excellent geometrician, he worked not only in sculpture, executing in his youth, in clay, some heads of women that are smiling, of which casts in plaster are still taken, and likewise some heads of boys which possess all the appearance of having come from the hand of a master, but in architecture, also, he made many drawings both of plans, as of other projections of buildings; and he was the first, although a mere youth, that put forward the project of reducing the river Arno to a navigable channel, from Pisa to Florence. He made designs for flour-mills, fulling-mills, and machines, which might be driven by the force of water: and because he wished that painting should be his profession,

he studied much in drawing from nature, and often in making models of figures in clay.'

As it were with the vividness of an eye-witness, although the account was written more than half a century after the events which he describes, Vasari has here shown how the mind of Leonardo exercised itself in many ways as soon as ever his contact with the intuitive influences of Florence became a reality. Already we see foreshadowings of the power to enter into the world of idea and with the arm of science to wrest conquests from the unknown. A note in the Codice Atlantico (12v.) shows how wide was the stimulus of intellectual curiosity which he experienced.

The association of eight names here occurring would seem to point to some precursor of that 'laudibile e scientifico duello' held at Milan in the days of Il Moro.

Three of the names are of mediocrities. Two – men 'of some importance in their day' – Carlo Marmocchi, astronomer and geographer, and Domenico di Michelino, who painted the picture of Dante in the Cathedral. The other three were those of intellectual giants: Benedetto dell' Abbaco, Argyropoulos and Toscanelli, and to each Leonardo probably put himself to school. Benedetto dell' Abbaco was the most famous teacher of mathematics in Florence in the fifteenth century. His numerous *Trattati d'abbaco* exist in the libraries of Florence and Siena. It may be assumed that Leonardo studied under him previous to entering Verrocchio's studio, and he would be the teacher whom Vasari refers to as having been continually perplexed by the doubts and difficulties which Leonardo presented to him. This Benedetto may have been his coadjutor, as was at a later date Fra Luca Pacioli. Argyropoulos, or 'Messer Giovanni Argiropolo,' styled by Filelfo most learned of all the Greeks in Italy, was welcomed to Florence by Cosimo de' Medici and numbered Poliziano and Lorenzo de' Medici among his pupils in philosophy. His lectures continued until Leonardo

was in his twentieth year, and he was probably sometimes a hearer. Argyropoulos translated the *Phisica*, *De Caelo* and others of Aristotle's works into Latin, and these translations may have served Leonardo as the basis of his knowledge of these treatises.

Paolo del Pozzo Toscanelli, here styled 'Maestro Pagolo Medico,' the *doyen* of the assembly, was born in 1397 and died in 1482. In the course of a life spent almost entirely in Florence he had gained eminence in mathematics, astronomy, geography, and medicine. The gnomon which he erected in the Cathedral in 1468 is the loftiest in Europe, but his chief memorial consists in the fact that his brain beat concurrently with that of Columbus in conceiving the possibility of a western route to Asia, and that in 1474, eighteen years before the date of Columbus' first voyage, he wrote him a letter to urge him to the attempt, priming him with scientific deductions and with the glamour of the Far East as mirrored in the pages of Marco Polo and the records of later travellers. Some of those who knew Toscanelli knew also of the project which must have welled into speech before it was written and sent on its way. Leonardo, too, may have heard of it, since it fell in the very middle of those youthful years in Florence during which his intellectual curiosity was at its highest, seeking every outlet of knowledge.

After he had returned to Florence from Milan, when Toscanelli was long dead and Columbus had made all his voyages, there is perhaps a record of new contact with the navigators in Vasari's statement of his having made a drawing of Amerigo Vespucci, 'a most beautiful head of an old man drawn in charcoal.'

But Amerigo Vespucci was only Leonardo's senior by a year, having been born in 1451, and if the drawing was done when he was an old man it is rather difficult to see when it can have been executed, because Amerigo Vespucci accompanied Ojeda on his voyage in 1498 and was at Seville in 1501 and published his account of his four voyages in 1504,

and there is no definite evidence of his having returned to Florence. Brockhaus has suggested that the Amerigo Vespucci referred to may have been the grandfather of the navigator who died in 1472, in which event the portrait must have been one of Leonardo's earliest works.

Martin Waldseemüller's *Cosmographiæ Introductio*, published in 1507, with a Latin translation of Vespucci's four voyages, contained the first suggestion that America should be the name of the new world. With the rapid growth of the idea grew also the fame of the navigator, and it seems therefore more natural to assume that Vasari's statement is intended to refer to him.

With the great Florentine family of the Vespucci it is natural to suppose him to have been acquainted, and he and Amerigo were almost exact contemporaries. They may have learnt together from Toscanelli.

Whatever the stimulus may have been we know from the list of books which are believed to have formed Leonardo's library, from his maps and from many passages of his writings how constantly his thoughts would dwell upon the far and unknown spaces of the earth.

Enigmatic and shadow-like, with a universality of mental endowment half legendary but potent among the tutelary influences in the Florentine background, is the figure of Leon Battista Alberti. Architect, mathematician, sculptor, philosopher, physicist, astronomer, inventor, student of classical monuments at Rome and able by his art as at Rimini to give their spirit rebirth, he linked science with art and practice with theory in a manner similar to that of Leonardo. He had died in Rome in 1472 – the year in which Leonardo was admitted a member of the Florentine Guild of Painters – and the possibility of direct influence is therefore almost negligible. It was, however, in his writings that the vigour of his mind found most complete embodiment. They moved Vasari to say that as regards name and fame 'fra tutte le cose gli scritti sono di maggior forza e di maggior vita.' An edi-

tion of the treatise on architecture was issued in 1485, with an introduction by Poliziano and dedicated to Lorenzo de' Medici. This, as well as the treatises on painting, mensuration and the *ludi matematici*, must have been well known to Leonardo. Alberti anticipated him in the construction of his canon of the proportions of the human figure, but as Professor Favaro has pointed out, Leonardo's canon has a closer resemblance to that of the Greeks as summarised by Vitruvius than to that of Alberti.

Among the forces in the background which would project themselves continually upon his nascent imagination were the works of Giotto, the Campanile with its bas-reliefs and the frescoes of Santa Croce and Santa Maria Novella, and also those of Masaccio in the Carmine with their heightening of reality.

Leonardo's reference to the two painters in a passage of his manuscripts serves to show how he isolated them from others in his reflections on the history of art.

Nor was Arezzo so far afield as to forbid us to suppose that he was drawn there on occasion by eager curiosity to study the creations of Piero de' Franceschi, with whose genius as revealed in San Francesco, in the treatment of problems of light and shade and in knowledge of the laws of linear and aerial perspective, his own works show marked temperamental affinity.

He must also have learnt something from the work of the Pollaiuoli, 'the spring from which the students of pure light and shade as distinguished from the colourists arose.' Antonio Pollaiuolo was probably the greatest living master of line. One source of his power he wrested from nature in a manner identical with Leonardo. We are told that he had dissected many human bodies to study the anatomy, and according to Vasari he was the earliest artist who investigated the action of the muscles in this manner that he might give them their due effect in his works. So perhaps came something of the tension of the bowmen in his Saint Sebastian in

the National Gallery, and in this picture executed in 1475 he shows himself in sense of aerial perspective far in advance of contemporary Florentine work.

The subtle gradations of tone of the wide-spreading landscape background are an index upon the road along which Leonardo travelled. His earliest dated drawing (1473) of Tuscan landscape reveals his essential unity of method; it lingers still in the sun-steeped hills and winding waterways of the Mona Lisa.

Together with these influences were those directly proceeding from Verrocchio's studio. With all Florence to choose from Ser Piero could have made no more fortunate choice. Not because there were not artists of equal eminence, but because the atmosphere was the most liberal and most congenial to Leonardo's many-sided talent, and because Verrocchio's intense practicality was a valuable element in the formation of his mind, proving as it did at once a stimulus and an antidote. Verrocchio shared with Antonio Pollaiuolo the inheritance of intellectual endeavour which distinguished the art of Florence.

The two carried on the scientific tradition with a zeal akin to that of Paolo Uccello, of whom it is told that when conjured by his wife to take rest and sleep in the night he replied only, 'O what a delightful thing is this perspective!'

Each being originally a goldsmith the first creative energy had found vent in the use of metals, and while the range of Verrocchio's technical ambitions and interests was almost boundless, his chief triumphs are associated with his work as a sculptor. Leonardo, who shared to the full Verrocchio's versatility, was sympathetic to every mood and interested in every technical problem. How many of these are found repeated in his own experience!

Making clocks and helmets, casting bells and cannon, executing commissions in wood, silver, marble and bronze, acting on public committees appointed to judge works of art, designing dresses and decorations in connection with

those tournaments and public festivities of the Medici which Poliziano has celebrated in song. The relation of master and pupil changed insensibly, as in such associated activities the years slipped by, and so in 1476, four years after he had been admitted a member of the guild of painters, Leonardo is still described as living with Verrocchio.

In this year Ser Piero da Vinci began to have legitimate issue by his third wife, and this circumstance no doubt tended indirectly to estrange Leonardo from his father's household. This may also have been brought about by the fact that in the same year the machinery of anonymous accusation which was one of the devices by which the Medici controlled Florence was put into operation against Leonardo and three others, with the result that they had to stand their trial for an alleged offence against public morals. On the first hearing the accused were discharged, with the proviso that they might be brought up again on any fresh evidence. Two months later the case was retried with the same result.

This finally disposed of the accusation. In the indictment Leonardo is entered as the son of Ser Piero da Vinci and as living with Verrocchio. This amount of description was quite unnecessary for purposes of identification. It may be observed that Leonardo's manuscripts, which register the communings of his mind, are instinct with the highest morality. As he wrote:

'Whoso curbs not lustful desires puts himself on a level with the beasts.

You can have neither a greater nor a less dominion than that over yourself.

It is easier to resist at the beginning than at the end.'

Although his activities were manifold Verrocchio's greatest triumphs were all won as a worker in plastic material, among the most significant being perhaps the David, the Boy with a Dolphin and the Colleoni, each of which far transcends in importance anything that he achieved by the use of

the brush. It is natural, therefore, to suppose that Verrocchio's influence upon Leonardo's work was somewhat greater in sculpture than in painting, and in view of Vasari's reference to Leonardo's early activity in the art of sculpture, 'the heads of women smiling and also others of children,' it is probable that these would show a somewhat closer approximation to the Verrocchiesque types than would be the case with early work in painting. The fable of Minerva springing forth fully armed from the brain of Jupiter, and admitted immediately into the assembly of the gods, offers a not altogether fantastic parallel to the spectacle presented by the sudden emergence in painting of the Leonardesque type, in the figure of the angel holding vestments which, according to Vasari, Leonardo painted in Verrocchio's picture of the Baptism of Christ. There is no apparent reason for discrediting Vasari's statement. The figure is conceived on simple lines, but the type is supple and sinuous to a degree far exceeding that of the other figures and in entire harmony with that which occurs in Leonardo's drawings of the early period.

The broad simple folds of the drapery are very similar to those in various of his studies of the drapery of a kneeling figure. Moreover, the tradition of Leonardo's authorship is far older than Vasari. It is found in the earliest of all guides to the art treasures of Florence, to wit Francesco Albertini's *Memoriale di molte statue e pitture della Città di Firenze*, published in 1510, i.e. during Leonardo's lifetime. He speaks of San Salvi as containing 'tavole bellissime, et un Angelo di Leonardo Vinci.'

Verrocchio's studio was much more than a school of the arts. It was something in the nature of a clearing house of ideas in what was the first intellectual centre of Italy. However great and far-reaching Leonardo's initial vision, it must have been broadened and expanded by the opportunities of intercourse which there opened before him. Among Verrocchio's pupils were the sculptors, Francesco di Simone, whose work in marble obsequies is ranked by Vasari with that of

his master, and Agnolo di Polo, who worked in terracotta so assiduously that the city was said to be full of figures by his hand.

Perugino is also numbered by Vasari among Verrocchio's pupils. Doubts have been thrown on the statement, and it is certain that Perugino's art training had proceeded under Umbrian masters before he came to Florence. Probably he frequented Verrocchio's studio more in the character of an assistant than a pupil, and as such exercised considerable influence over the nascent art of Lorenzo di Credi, whose devotional grace and facile smoothness of texture would seem to be in part derived from him. Giovanni Santi bears testimony to Perugino's association with Leonardo in the well-known lines in his Rhyming Chronicle:

'Due giovin par d'etade e par d'amore
Leonardo da Vinci e' l Perusino
Pier della Pieve ch'è un divin pittore.'

Santi wrote at Urbino, where he found employment, artistic and otherwise, in the service of the Montefeltro. What he knew of Florence and her painters he may have had from Piero de' Franceschi, whose host he was when the latter first visited Urbino. The lines do not suggest exactness of knowledge, Perugino being in fact the elder by six years. That Leonardo studied the work of the Umbrian painter may be inferred from the fact of a reference to 'a nude of Perugino' occurring in the Codice Atlantico.

The only other painter among his contemporaries to whom Leonardo refers by name in his manuscripts is Botticelli – who was not a pupil but a frequenter of Verrocchio's studio.

The references suggest a considerable degree of intimacy.

In the Treatise on Painting he uses his name 'il nostro Boticella' to point the moral that no painter is universal who does not devote himself equally to all the things which appertain to painting:

'For anyone who does not care for landscapes imagines that landscape painting is a short and easy process; thus our Botticelli has said that such study was useless, for by merely throwing a sponge full of various colours at a wall it would leave a stain in which one could discern a beautiful landscape. It is indeed true that in such a stain one may see various fancies if one has a mind to look for them, to wit men's heads, various animals, battles, rocks, seas, clouds, forests and other things like these, just like the sound of bells in which you can hear whatever you wish. But even if these stains give you the idea they do not teach you how to finish any one detail; and of these [stains] such a painter makes very poor landscapes.'

A passage in the Codice Atlantico, as Solmi has pointed out, contains a fragment of a discussion between the two, the theme being the law of diminishing perspective:

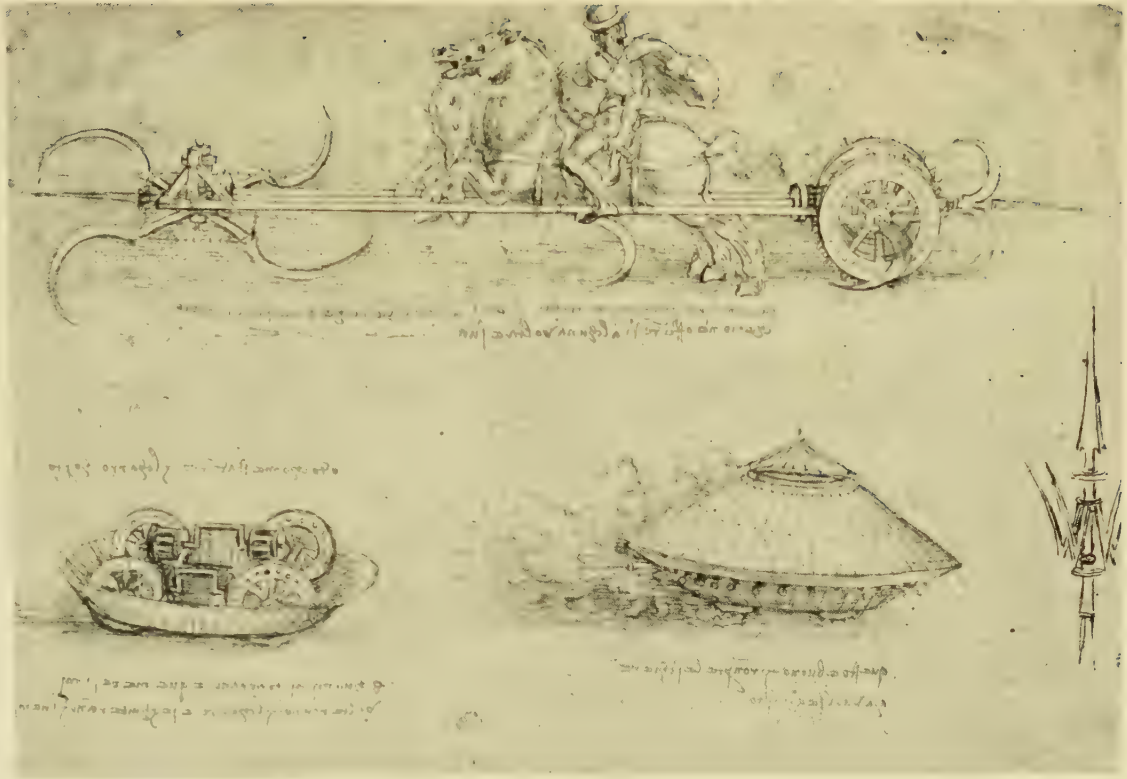
'Sandro! you do not say why these second things seem lower than the third.'

'The eye between two parallel lines will never see them for so great a distance that they meet in a point.'

Botticelli's prominence in the art world of Florence is shown by the fact that immediately after the failure of the conspiracy of the Pazzi he was chosen by the Signoria to paint in effigy the chief conspirators upon the façade of the Palazzo Pubblico. Among the rest was the figure of Bernardo Bandini, who had struck the mortal blow at Giuliano de' Medici, beneath which, in allusion to his escape, Lorenzo de' Medici placed the inscription:

'Son Bernardo Bandini, un nuovo Giuda,
Traditore micidiale a chiesa io fui,
Ribello per aspettare morte più cruda.'

('I am Bernardo Bandini, a new Judas. Murderous traitor in a church was I. A rebel who must look for a death more cruel.')



WAR MACHINE WITH SCYTHES AND ARMOURED CAR

By the end of the following year the event prognosticated had taken place. The long arm of the Medici had reached to Constantinople. The refugee had been given up to their envoy to be brought to Florence, where he was hanged on the 28th of December 1479.

Leonardo made a pen-and-ink sketch of the figure as it swung in the pathos of death from one of the windows of the Bargello, and added a full description of the dress:

'Small cap tan-coloured, doublet of black satin, black lined jerkin, blue coat lined with the throats of foxes and the collar of the coat lined with black and white stripes of velvet. Bernardo di Bandino Baroncelli. Black hose.'

It is impossible to say whether the primary purpose of sketch and notes was for use in a painting, or whether notes and drawing alike are just instances of that attitude of impassivity mingled with observation, half interest half detachment, which characterizes Leonardo's rare references to public events. The latter seems more probable.

If intended for a painting it went no further. Doubtless Botticelli's work met sufficiently the need of pictorial commemoration of the event. Its existence proved an obstacle to an accommodation of differences with the Pope, who may have resented the appearance of the effigy of Archbishop Salviati as one of the malefactors, and consequently the figures were destroyed in 1494, after the flight of Piero di Lorenzo de' Medici, when the remnant of the Pazzi were suffered to return.

Botticelli had commemorated the triumph of the Medici in a manner more enduring in the Adoration of the Magi with the Medici portraits which he painted for S. Maria Novella.

The contrast between the record of the two painters in the matter of the Pazzi Conspiracy illustrates how very small was the part which Leonardo took in the public life of Florence. He is the spectator who makes a drawing, while Botti-

celli, only six years his senior, is entrusted with the work of painting the row of conspirators; yet, as Leonardo's manuscripts show, in the discussion of art they met on equal terms.

In considering the Florentine influences we may also note the significance of a line in his manuscripts in which he speaks of 'i medici' as having both created and destroyed him. The remark was formerly interpreted as referring to the medical profession, of whom he shows himself elsewhere an unsparing critic; but Dr. Calvi has pointed out that in its most natural interpretation the line refers to his treatment by the Medici, the first half associating the rise of his fortunes with Lorenzo de' Medici, the second having reference to the breakdown of his hopes of employment in Rome in 1514 under the Medici pope.

The Anonimo Gaddiano, whose fragmentary biographies form the unique source of many particulars in the lives of Florentine artists, states that Leonardo in his youth lived with il Magnifico Lorenzo de' Medici, and that he gave him quarters and set him to work in the garden of the piazza of San Marco. It was there that Cosimo de' Medici had caused a number of fragments of antique statuary to be brought together, among these a fragment in red marble of a statue of Marsyas which, according to Vasari, was given by Lorenzo de' Medici to Verrocchio to restore. It would seem natural to connect the service of Leonardo in the garden of the Medici with that of Verrocchio, and to suppose that Leonardo lived there after he had ceased to be one of Verrocchio's household, i.e. at some period after 1476.

The statement of the Anonimo Gaddiano has been subjected to criticism. Solmi suggests that Leonardo only resorted there for purposes of study, but as Poliziano and at a later date Michelangelo were accommodated with quarters in the Medici garden, there is no inherent improbability in the statement of this having happened in the case of Leonardo.

Verrocchio, like Botticelli, had a rapid power of execution, and this was far more to the taste of the Magnifico than were the infinite delays and preparations of Leonardo. Record tells of bas-reliefs by Verrocchio of Alexander the Great and Darius, sent by Lorenzo to Mathias Corvinus, the King of Hungary, and his skill in casting in bronze caused him to be employed to execute the monument to Giovanni and Piero de' Medici. Leonardo had given no such readily cognizable proofs of power to execute, and so the commissions were lacking. There is, however, evidence of his having received two commissions for altar-pieces. One from the Signoria, for the Chapel of S. Bernard in the Palazzo della Signoria, was, Uzielli conjectures, owing to Lorenzo de' Medici, but possibly also the fact of Ser Piero da Vinci's connection with the Signoria may have contributed to the awarding of the commission. It was not executed, and the subject of it can only be a matter of inference.

A commission for an altar-piece was also given him by the monks of S. Donato at Scopeto. It was begun and then abandoned and may be identified with the unfinished Adoration of the Magi in the Uffizi.

The abandoning of these two commissions after, in the case of the second at any rate, more labour in preparatory studies than would have sufficed for most of his contemporaries to bring a work to completion, enables us in part to understand why his works as an artist were so few:

Vasari expresses it in Petrarch's line:

'Tal che l'opera fosse ritardata dal desio.'

Reviewing the evidence of contemporary record, we are conscious that it reveals very little of the life of Leonardo during these Florentine years.

In a city where art and learning had unexampled vigour, where culture was ever writing anew its memorials with the pen of the historian, the chronicler, the diarist and the poet, he with his glorious intellectual and artistic powers passed

through the first decade of maturity, the period of the first flowering of the human intellect, and went away at the age of thirty, leaving behind him hardly any record of himself, and in art nothing at all comparable in its ripe perfection to the works of his contemporaries. In lieu of these we find many preparatory studies and a very few works, and these for the most part unfinished. While Verrocchio and Botticelli were sedulously executing such commissions as offered in sculpture and painting, Leonardo was giving free rein to every intellectual impulse, exploring every avenue of thought with eager curiosity and thereby laying the foundations of that universality which has caused his name to serve as a symbol for the whole of the Italian Renaissance. Although Vasari had no first-hand knowledge, and wrote more than half a century after the termination of this period of Leonardo's life, something of the personality of the youth of Leonardo lives and pulsates in the spirit of his narrative. It portrays him as a prodigy of all the talents, of manly strength and power, wayward, volatile, hospitable, warm-hearted, generous to a degree, alive to every influence of beauty, every stirring of curiosity. It is difficult to harmonize all this with that devotion to knowledge of which the manuscripts offer abundant proof.

It is certain that in neither capacity did he serve the needs of Lorenzo de' Medici.

The departure to Rome early in 1481 of the principal Florentine painters Botticelli, Ghirlandaio, Perugino, Cosimo Rosselli, to paint in competition in the Sistine Chapel at the invitation of Sixtus IV, emphasized his isolation. He too looked away for some new field of endeavour, and the field was Milan.

On the occasion of the visit to Florence in 1471 of Galeazzo Maria Sforza the Signoria had entrusted Verrocchio with the charge of the festivities. Leonardo was then his pupil, and very probably he was associated with him in the work. This was his first contact with a Sforza, and the occa-

sion, marked by great spectacular magnificence, may have formed a rallying ground for his thoughts when dissatisfied with conditions in Florence. When, moreover, after the assassination of Galeazzo Maria his brothers were banished from Milan, Ludovic Sforza was ordered to reside at Pisa, which was within the territories of Florence, and while there was treated with marked consideration by Lorenzo de' Medici, and this continued after his recall.

The records which have to do with Leonardo's departure to Milan are concerned with a new phase of his intellectual life, namely his skill as a musician.

The testimony of the earliest biographers and of various contemporary authorities is unanimous that among the arts which he practised was that of music.

Vasari states, 'he gave some little study to music, but soon resolved to learn to play the lyre, and being by nature of a most lofty spirit and full of grace, he sang divinely to that instrument, improvising upon it.'

Paolo Giovio, the Anonimo Gaddiano, Lomazzo, and Luca Pacioli all refer to his skill as a musician, the Anonimo also mentioning that he was the instructor in the lyre of Atalante Migliorotti – a relation which the difference of fourteen years in their ages would render quite natural. We owe to the same authority the statement that at the age of thirty Leonardo was sent by Lorenzo il Magnifico to the Duke of Milan with a present of a lyre, and that he had with him Atalante Migliorotti, who was unique in playing this instrument. Vasari's account confirms this. He makes an obvious error as to the date of his departure as from a multiplicity of evidence Leonardo is known to have been in Milan earlier than 1494; nor does he mention who was Leonardo's companion; he does, however, associate Leonardo's departure to Milan with his skill as a musician, he having been invited with great honour to Milan by the Duke, who delighted greatly in the music of the lyre, so that the master might play before him, and he states that the instrument

which Leonardo took with him was of his own construction and was made almost entirely of silver in the shape of a horse's head, this being calculated to enhance the sweetness of the sound. Music as we know from the testimony of Calmeta was an art to which Ludovic Sforza was devoted, and musicians were ever welcome at his court.

There apparently Atalante Migliorotti remained, playing and making musical instruments until the year 1490 when he was summoned to Mantua by Francesco Gonzaga in order to take the leading part in the representation of Poliziano's Orfeo.

It was presumably an old Milanese tradition which caused Amoretti to say in his memoir of Leonardo, written in 1801, that a treatise on music in the Trivulzio Library, written by a priest named Florentio and dedicated to Ascanio Sforza, has as part of the frontispiece a miniature of Leonardo playing the lyre. The tradition does not find favour with the compiler of the catalogue of the Trivulzio Library on the ground of lack of resemblance, but this would depend somewhat upon the quality of the artist.

Leonardo's manuscripts contain various drawings of musical instruments and studies in the phenomena of acoustics, but apart from the evidence which they offer the testimony of contemporary record and of the early biographers fully establishes the fact that he was famous as a musician. It was as one who knew from his own mastery the power of Orpheus with his lute that Leonardo, as Vasari tells us, when painting the portrait of Mona Lisa retained musicians continually to play and sing before her.

MILAN 1483—1499

If Leonardo's departure to Milan is to be connected with his skill as a musician, and this would seem to follow from the evidence of the early biographers, it is abundantly clear that in the immediate circumstances he was only taking occasion as it served. Ambition was made of sterner stuff than lute-strings. Milan was the goal because it seemed to offer such prospect of full use of his talents as Florence had hitherto denied. Ludovic Sforza, fourth son of the condottiere Francesco Sforza, founder of the ducal house, permitted by the Duchess Bona to return in 1479 to Milan where she ruled as regent for her son, Gian Galeazzo, after the assassination of Galeazzo Maria Sforza in 1476, had fulfilled to the letter within little more than a year the prediction which the old minister, Cecco Simoneta, made to the duchess when he heard what she had done and warned her that the step she had taken would cost her the state and him his life. Proclaiming Gian Galeazzo fit to govern at twelve years of age and thereby abolishing the regency, he had ruled in his nephew's name as virtual Duke of Milan until the death of the latter in 1494 had opened the way for him to assume the title.

Was there any justification, it may be asked, for this usurpation.

The answer would take into account that rule in Renaissance Italy demanded before all else personal capacity, that the house of Sforza was none too well established, that already papal intrigues with the Swiss had had as their object the establishment of a republic in Milan and that on the testimony of contemporary chroniclers Gian Galeazzo was weak both in mind and body.

As a usurper Ludovic committed a grave error of judgment in permitting the marriage of Gian Galeazzo with Isabella of Aragon, as by so doing he was giving the King of Naples an interest in the fortunes of the young duke and thereby raising up unnecessarily a powerful enemy for himself. In any support which as a consequence he subsequently

gave to the expedition of Charles VIII against Naples he was virtually handling a two-edged sword, because the French had dynastic claims upon Milan as well as Naples, and to permit their passage through Italy was to lay bare the richness and the defencelessness of the land. It would hardly be possible to conceive Lorenzo de' Medici as guilty of either of these signal blunders; he had found a way to maintain friendship with France and yet to thwart French ambitions in Italy, and fate weighing in the scales the life of each ordained that the one should die in the plenitude of power, the other in exile.

They had in common that each created a legend – a legend of such quality and potency that their names have acquired a certain tutelary significance in connection with that period of intellectual vitality in Florence and Milan which witnessed the creation of the most characteristic products of the art of the Renaissance. That the legend is the more sharply defined in the case of Ludovic Sforza is due to the fact that the intellectual and artistic activity of Milan during the years of his rule stands out in richer contrast against the other pages of its history than does that of Florence under Lorenzo de' Medici, and this by reason primarily of the coming of Leonardo and the prestige which the universality of his genius and the magic of his creations conferred upon the court of Il Moro.

In his attitude to artists and men of letters, to whom he looked to have the deeds of the house of Sforza fitly commemorated, Ludovic was in intention a veritable Maecenas, and as the news of this was bruited through Italy a swarm of would-be beneficiaries came flocking to his court, like 'bees seeking honey,' as the Florentine Bernardo Bellincioni has it, who was himself one of them:

'Di virtuosi ha la sua corte piena . . .
Qui come l'ape al mel vienne ogni dotto . . .
Da Fiorenza uno Apelle qui ha condotto.'

(Of artists his court is full . . . here like the bee to honey comes every man of learning . . . from Florence he has brought here an Apelles.)

A marginal note in Bellincioni's Rime published in 1493 identifies the Florentine Apelles as 'Magistro Leonardo da Vinci,' a time reference in the same poem fixing the date of its composition as 1486 or 1487.

Another of Bellincioni's sonnets groups together four illustrious men who have grown up under the shadow of Il Moro, their names being the scholar Merula, whom Ludovic chose to be the historian of the Sforza family, a task which at his death devolved upon Calchi and finally upon Corio, the goldsmith Caradosso, Giannino the gunfounder of Ferrara, and Leonardo.

As a patron of art Ludovic's primary purpose was to give vitality to the Sforza tradition by an equestrian statue of Francesco Sforza. The project of such a statue in gilded bronze had been originally formed by Galeazzo Maria in 1473, and after the Lombard artists had met in conference the commission was awarded to the brothers Cristoforo and Antonio Mantegazza, the sculptors of the Certosa; but they seem to have done nothing more than make calculations as to the weight and cost of the material. Ludovic must have revived the project as soon as he gained power, since according to Vasari a design and a model for the statue of Francesco Sforza were executed for him by Antonio Pollaiuolo.

The former of these may be identified with a drawing now in the Print Room at Munich.

Laudatory verses written by a certain Baldassare Taccone of Alessandria on the occasion of the marriage ceremonies held in November 1493 of Bianca Maria Sforza, sister of Gian Galeazzo, with the Emperor Maximilian, when Leonardo's clay model of the statue was set up in the piazza of the castle of Milan, refer to it as the fulfilment of a long-cherished project deferred for want of a capable artist.

'E se più presto non s'è principiato
La voglia del Signor fu semper pronta
Non era un Lionardo ancor trovato.'

Fra Sabba da Castiglione, who witnessed the destruction of the model by Gascon bowmen, speaks of Leonardo as having worked upon it for sixteen years, which would place the time of its commencement as 1483, and might suggest a literal interpretation of an expression used by Leonardo in a paragraph on the reverse of the draft of a letter to the Commissioners of Buildings at Pistoia: 'here is one whom his Lordship has invited from Florence to do this work of his, and he is a capable master, but has so much to do that he will never finish it.' These words, however, should be considered as less authoritative because the paragraph does not form part of the letter.

In it Leonardo urges the Commissioners not to be in haste to award the commission for the doors, because of the importance of the work and the shame of having it done badly and spending their money in buying their own disgrace. He concludes characteristically with splendid hyperbole and the touch of diffidence that comes from overmuch communing with thought.

'There is no capable man – believe me – except Leonardo the Florentine – who is making the bronze horse of the duke Francesco, and you must not count upon him because he has work for his whole lifetime and I fear that the work is so great that he will never finish it.'

The draft of the well-known letter to Ludovic is inconsistent with the supposition that he was invited to Milan to work on the statue, although it shows that the thought of it may have operated in his mind.

The omission of music from the list of abilities there enumerated tends indirectly to confirm the statement of the Anonimo, for if that was his ostensible mission there would be no need to make mention of it.

The concluding passage of the letter to Ludovic, in which the writer offers to make trial of his inventions in the Duke's park or in whatever place shall please him, seems to point to the letter having been written immediately after his arrival in Milan rather than at Florence.

Its contents show that it was written with an eye to the prevailing local conditions. Ludovic Sforza had made a host of enemies in his rise to political authority. Other powers looked askance at his usurpation, and the duchess Bona's faction in Milan received new sympathisers from the spectacle of the ignominious tutelage of Gian Galeazzo. The year 1482 witnessed the temporary alliance of the armies of Naples and Milan in the war of Ferrara to help in defending the duchy against the attacks of Venice and the Papal forces, and the association gave the Neapolitan commander, the Duke of Calabria, the opportunity of remonstrating with Ludovic on the position accorded to his daughter's affianced husband, with as consequence the commencement of another change in the kaleidoscope of Italian political combinations. In an atmosphere thus pregnant with storm Leonardo looked primarily to find employment, and in the preamble of his letter to Ludovic he speaks of having seen and considered the experiments of all those who pass as masters in the art of inventing instruments of war and of having found their inventions to differ in no way from those in common use and therefore venturing to ask for the opportunity of drawing his Excellency's attention to certain secrets of his own invention.

They relate to the construction of light portable bridges 'with which to pursue and defeat the enemy,' pontoons and scaling ladders, devices for cutting off the water from trenches, others for demolishing all fortresses except those of which the foundations are upon stone, apparatuses for constructing tunnels to pass if necessary underneath trenches or rivers, armoured wagons carrying artillery capable of breaking through the closest ranks of the enemy, and thereby

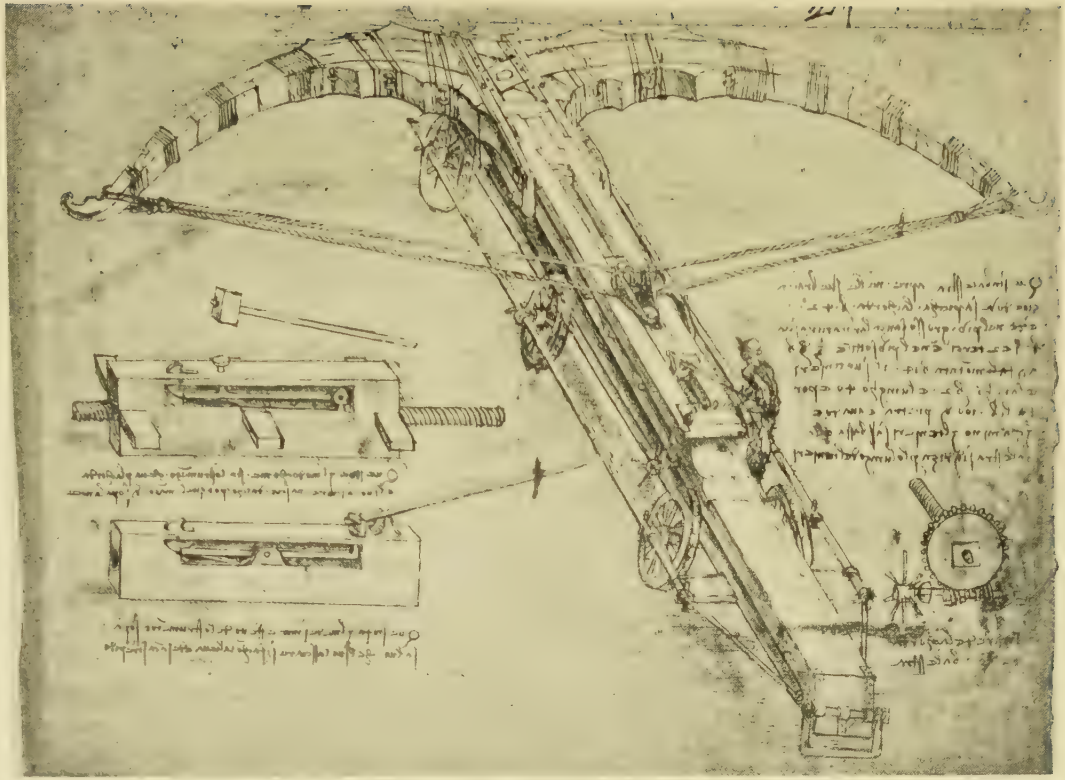
opening a way for the infantry, cannon mortars and light ordnance both ornamental and useful in shape and different from those in common use, and for occasions when these are not possible catapults, ballista, mangonels, and other instruments of admirable efficacy not in general use. 'In short,' he concludes at the close of the sections which relate to land warfare, 'I can supply as occasion requires infinite means of attack and defence.'

'And if,' he continues, 'the fight should take place upon the sea, I can construct many engines most suitable either for attack or defence, and ships which can resist the fire of the heaviest cannon, and powders or vapours.'

Does it all seem mere rodomontade? To be treated as such by Ludovic, – if indeed it ever reached his eye?

Or may we discern in it something of the impracticality of the thinker adventuring for the nonce in the crowded fields of action? Such impracticality as figures in that production not altogether dissimilar in scope to this, the 'letters patent for the making of military machines' issued by Charles the First at Hampton Court in 1626 in favour of Mr. William Drummond, the poet Drummond of Hawthornden, who claimed to have expended much time, labour and money and by the application of mathematical and physical principles to have invented certain new arms, and perfected old and imperfect ones and rescued others from oblivion, especially warlike engines for use on sea or land.

They bore such arresting names as Thundering Rod, Fiery Wagon, Cavalier Errant, Leviathan and Sea-Postilion, and were, in intention at any rate, devices for increasing the effectiveness of a comparatively small number of combatants by means of powerful engines. The right to make all these inventions was reserved to the poet for three years, and then presumably it lapsed through non-performance, for the poet had spent in travel the years of the currency of the patent, and soon afterwards he married, and no doubt then thought no more of Cavaliers Errant or Sea-Postilions.



BALLISTA

While fate brought no such change of circumstance to disturb the tenor of Leonardo's ways it does not appear that any of his offers of military inventions met with more immediate opportunity than did those of Drummond, and yet the roll of his manuscripts permits us abundantly to know that he had studied practically the construction and use of each engine and instrument of warfare which is specified in his letter. The evidence is found in Manuscripts B and D of the Institut de France, in the Codice Atlantico, and in various drawings in the Royal Library at Windsor. It has been reproduced exhaustively by Dr. Paul Müller-Walde in the section on his work as military scientist in his study of Leonardo (Lebensskizze und Forschungen).

In the extraordinary mass of detail which he has there presented, in notes, sketches and diagrams of the mechanism, construction and use of pontoons, scaling ladders, battering rams, tanks, mines, cannon, and other apparatuses of warfare, he would seem to be presenting the completed results of the work of a life devoted principally to the study of the art of war, which, as he says, is the natural impression derived from the terse practical phraseology of these clauses of Leonardo's letter to Ludovic Sforza.

Then at a word the vision changes, and what from its fullness might seem to be a rounded whole is revealed as only a section – at best a relatively small and unimportant section – of the activities and aspirations which pulsate through the mind of the writer.

'In time of peace,' he continues, 'I believe that I can give you as complete satisfaction as anyone else in the construction of buildings both public and private, and in conducting water from one place to another.

'I can further execute sculpture in marble, bronze, or clay, also in painting I can do as much as anyone else, whoever he may be.'

'Moreover, I would undertake the commission of the

bronze horse, which shall endue with immortal glory and eternal honour the auspicious memory of your father and of the illustrious house of Sforza.'

There is a ring of futurity about the words 'in time of peace' and all those that follow. While the Pope and Venice are leagued to destroy Ferrara and divide up her territories, peace is not likely to be near accomplishment.

So in the concluding paragraph of the letter he harks back to his war inventions: 'and if any of the aforesaid things should seem to anyone impossible or impracticable, I offer myself as ready to make trial of them in your park, or in whatever place shall please your Excellency, to whom I commend myself with all possible humility.'

We know from Fra Sabba da Castiglione that Leonardo was left-handed, and the script in by far the greater part of his manuscripts is what is known as left-handed, the direction of it being from right to left. The fact of this not being the case in the draft letter to Ludovic Sforza has caused a doubt as to its genuineness, but of this its contents afford a convincing proof, for the reason that in all the category of services which are there offered there is none which does not form the subject of scientific investigation and research in Leonardo's manuscripts, sufficient at any rate to justify him in offering the trial which he solicits in the park of Milan. It does not, however, appear that he was furnished with any immediate opportunity. The victories which eased for a decade Ludovic's position were won rather in the field of diplomacy than by stress of combat. His dominant purpose was to give Milan a greater measure of the splendour and security and richness of social well-being which were to be found in other capital cities of Italy, and as a means of attaining this end Leonardo's powers as an artist were of pre-eminent importance.

Side by side with the commission for the equestrian statue which had long awaited a competent master and which

he undertook immediately after coming to Milan, preparing himself for the work in characteristically scientific fashion by studying equine anatomy, problems of equipoise, weight and movement and the lessons to be learnt from existing examples of the sculptor's art, he commenced those works of more immediate and practical utility to which the letter refers, namely the construction of buildings both public and private and the making of watercourses.

It is natural to think of Leonardo's inventive and constructive powers as ranging freely through the various enterprises upon which Ludovic Sforza was engaged. Sketches, diagrams and notes in the manuscripts offer convincing proof of this, but the time indications of the greater number are at best only a matter of inference and do not enable us to define with any degree of certainty the chronological order of these activities. It may be that the devices for sea warfare mentioned in the letter engaged his attention at an early period. Calvi in his admirable work on the manuscripts considered as biographical and historical documents, has suggested that Leonardo submitted proposals of submarine attack for Ludovic's consideration in connection with the war against Venice in 1483 and 1484 on behalf of Ferrara, or that they were for consideration in 1487 in connection with the responsibility which Milan then assumed for the naval defence of Liguria.

The plague which visited Milan in 1484 and 1485, and which is said to have caused the death of 50,000 of the inhabitants, provided the opportunity of such measure of reconstruction of the capital as would harmonize naturally with the ambitions of Ludovic Sforza. A further opportunity for the construction of examples of domestic architecture of an elaborate character was offered by the work which was done a few years later at Vigevano, which was Ludovic's favourite residence, where in 1492 he built a palace and where he subsequently so changed the town by his improvements that, according to the Milanese chronicler

Cagnola, it deserved to be called not Vigevano but 'Citta Nova.'

To the first of these undertakings, according to Solmi, to the second, according to Calvi, are to be attributed the various drawings and notes occurring principally in Manuscript B of the Institut, in which Leonardo has considered the construction of a model city.

The most striking feature of these sketches is the provision of a double system of high-level and low-level roads in order to accommodate different kinds of traffic, the upper being for pedestrians, the lower for carts and other vehicles.

The roads are to be flanked by arcades, and in one of the sketches Leonardo gives a general view of such a town with the roads outside leading up on viaducts to the high-level roads within, in others he shows how the roads at the two levels are connected by means of steps, and how the lower arcades are lighted by openings in the upper roadway.

Another sketch contains a plan for streets and canals inside a town, arranged in such a way that the canals serve somewhat the same purpose as the lower system of roads, and goods may be delivered in the cellars from boats.

A note on this sketch states that the width of the streets should be equal to the average height of the houses. This is identical in purport with the provision adopted by the London County Council in laying out new streets in order to secure the necessary minimum provision of air and light for each house.

In the passage first referred to he states that for purposes of irrigation the city should be built either near to the sea or to a large river. In the second, in which there is a reference to canals, he says with regard to the situation that choice should be made of a fine river which is not made muddy by the rains, such as the Ticino, the Adda, and many others. The mention of the Ticino seems, as Calvi suggests, to favour the supposition that Vigevano was the site of the city of

which he was planning the construction, and there is evidence of Leonardo having been employed there in 1494 in irrigation works. The whole evidence, however, hardly avails to enable us to define exactly the purpose that Leonardo had in mind in the construction of these architectural plans, and still less does it serve to give them a local habitation and a name. In both of the passages cited he alludes to alternative positions as equally suitable for the construction of the type of city he was planning, e.g. 'near the sea or a large river,' 'by the Ticino, the Adda, or other river,' and this seems clearly to show that he was not thinking of a definite locality and an immediate commission, but that the passages either formed part of a projected treatise on architecture, or he was preparing them in order to embody his own ideas and to test his capacity to serve Ludovic Sforza or another patron if and when opportunity offered.

The irrigation works in the plain of Lomellina on which he was employed in 1494 comprised the construction of series of terraces in the bed of the river.

Sketches in the manuscripts show their action in regulating the flow of the water and thereby conserving it for the fertilization of Lombardy. These and the studies which he made two years previously for improving the navigability of the Martesana are the measure of the opportunity afforded him to carry out his promises to Ludovic Sforza to serve him in the construction of watercourses.

More definite in its reference to Milan than any of the drawings of town construction would seem to be the passage in the Codice Atlantico (R. 1203) in which the spirit of Leonardo is seen brooding like a prophet over the evils of overcrowding and propounding a solution which contains the kernel of the modern ideal of dispersion into garden cities. It takes the form apparently of a memorandum to Ludovic Sforza setting forth the advantages, ethical, hygienic, and material, which would result from rebuilding the capital and so extending the site as to insure the full health and

strength of its inhabitants. The suggestion of the dispersal of the great congregation of people into ten towns each with thirty thousand inhabitants can only refer to Milan.

The letter is couched in the form of an exhortation:

'There will be eternal fame also for the inhabitants of that city built and enlarged by him.

'All communities obey and are led by their magnates, and these magnates ally themselves with their lords and constrain them in two ways: either by relationship when their children are as it were hostages as security and pledge of their suspected faith, or by property when you make each of them build a house or two within your city which may yield some revenue, . . . and there will be ten cities, five thousand houses with thirty thousand inhabitants, and you will separate this great congregation of people who herd together like goats one on top of another, filling every place with foul odour and sowing seeds of pestilence and death.

'And the city will gain beauty worthy of its name, and it will be useful to you by reason of its revenues and the eternal fame of its enlargement.'

M. de Geymuller has classified Leonardo's architectural studies under the headings of studies for buildings intended to be constructed and theoretical investigations and treatises, the latter being much the more numerous. Among the former are those for a watch-tower with ravelin, intended probably for the Castle of the Sforzas, and a careful study of a cupola crowning a fortified corner tower on the same page as a study for the head of S. James for the Last Supper. Others spring from the fact of his having been one of the four artists who in 1488 presented models for the construction of the 'tiburio' or central cupola of the Cathedral.

Among the four was Luca Fancelli, who was one of the earliest to conceive the possibility of the canalization of the Arno, a project upon which Leonardo subsequently made researches, and also Bramante, who is three times referred to

in his manuscripts and the influence of whose work is clearly visible in his studies of dome architecture.

His close association with the court is shown by the fact that in 1487, when Isabella of Aragon came to Milan to marry Gian Galeazzo, and the ceremonies were concluded with an operetta entitled Il Paradiso with verses by Bernardo Bellincioni, he was selected to construct the mechanism. It was called Il Paradiso, observes the chronicler, 'because there was there constructed, with great skill and art by Master Leonardo Vinci the Florentine, Paradise with all the seven planets revolving, and the planets were represented by men in form and costume similar to those described by the poets.' Soon after this he was called upon to construct a bath for the Duchess Isabella, as the manuscript tells us, 'in the midst of the labyrinth of the Duke of Milan.' This was fitted with a key to regulate the flow of the water so that it might be filled with three parts of warm water and four parts of cold.

Presumably he tired of activities such as these, and so it came about that in June 1490, when he was summoned with Francesco di Giorgio to Pavia to advise about the construction of the Cathedral, Francesco di Giorgio returned in a fortnight and Leonardo remained for more than six months, spending the time in study.

So long the hesitations which marked the stages of conception of the statue that the Florentine Agent at Milan wrote on the 22nd of July 1489 to Lorenzo de' Medici to say that Signor Lodovico, being desirous of erecting a worthy monument to his father and having already commissioned Leonardo da Vinci to construct the model, namely of a colossal horse of bronze with the Duke Francesco in armour, has asked him, since he wishes it to be done as well as possible, to write on his behalf to Lorenzo, and request him to send one or two masters who are used to such work, for although he has entrusted the commission to Leonardo he has not much confidence in his capacity to carry it out.

The letter, according to Horne, leaves it an open question

whether Ludovic desired a sculptor to begin the statue afresh or merely a bronze-caster to execute Leonardo's model. In either case, the knowledge of Ludovic's intention may have roused Leonardo to fresh effort. A note on the cover of Manuscript C. of the Institut says, 'on the 23rd day of April 1490 I commenced this book and recommenced the horse.' The latter half of 1490 was spent at Pavia, and he may then have made the notes in the Codice Atlantico, fol. 147r, about the antique statue of Regisole.

From the ordered quiet of Pavia and of her famous library, where, as another note in the Codice Atlantico shows, he used to go in order to consult books which he needed for study ('try to get Vitolone which is in the library at Pavia and which treats of mathematics'), he was recalled to Milan in January 1491 on a summons from the court, with other artists, in order to assist with the pageant which marked the occasion of the double marriage of Ludovic Sforza with Beatrice d'Este, and Anna Sforza with Alfonso d'Este. He stayed, as he says, in the house of Galeazzo di Sanseverino, being employed there in devising costumes for a masquerade, in which, as a chronicler relates, a troop of wild Scythians mounted on Barbary steeds galloped across the piazza until they reached the spot where the ducal party were seated and there, throwing off their disguises, revealed themselves to be knights magnificently equipped, with Galeazzo di Sanseverino as their leader. At the signal as he planted his lance a huge Moor advanced and recited verses in praise of the Duchess Beatrice. Leonardo mentions his work in devising the costumes in the course of a lengthy record in one of his manuscripts (C. 15 (b)) of the peculations of one of his pupils, who stole money from a purse of one of the servants while they were busy in trying on the costumes of the Scythians, whom he styles 'omini salvatici' wild men. It was this same Galeazzo di Sanseverino whose horses served Leonardo as models for the Sforza statue. Notes in the manuscripts refer to 'Messer Galeazzo's big genet,' 'Messer

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Galeazzo's Sicilian,' and 'the measurement of the Sicilian, the leg from behind, seen in front, lifted and extended.'

From the time of the tournament he must have worked upon the statue as continuously as circumstances allowed, since in November 1493, when Milan was again in festival to celebrate the marriage of Gian Galeazzo's sister, Bianca Maria Sforza, with the Emperor Maximilian, the work was so far advanced that the model was exhibited under a triumphal arch erected in the piazza in front of the Castle. The occasion was the signal for an outburst of laudatory verses from the court poets. Of these Baldassare Taccone is the most circumstantial and on the whole the most reliable, although somewhat constrained in his facts by the exigencies of rhyme. His opening lines visualise the scene:

'Vedi che in corte fa far di metallo
per memoria del padre un gran colosso
i' credo fermamente e senza fallo
che Gretia e Roma mai vide el più grosso.
Guarda pur come è bello quel cavallo!
Leonardo Vinci a far lo sol s'è mosso.
Statura, bon pictore, bon geometra
un tanto ingegno rar dal ciel s'impetra.

'E se più presto non s'è principiato
la voglia del Signor fu sempre pronta
non era un Leonardo ancor trovato
qual di presente tanto ben l'impronta
che qualunque che el vide sta amirato
e se con lui al paragon s'afrunta
Fidia: Mirone: Scoppa e Praxitello
diran che al mondo mai fusse el più bello.'

('See how in the court he causes a great colossus to be made of bronze to the memory of his father. I believe firmly and without error that neither Greece nor Rome ever saw a greater. Only look how beautiful is the horse! Leonardo

alone has made it. Sculptor, fine painter, fine mathematician, so great an intellect rarely does Heaven bestow.

'And if it was not commenced more speedily the will of the Lord was always ready, but he had not yet found a Leonardo, who has now prepared it so well that whoever beholds it stands in admiration, and if with him as an example one confronts Phydias, Myron, Scopas and Praxiteles they will say that there has never been one more beautiful in the world.')

In spite of the poet's testimony it is practically certain that the statue was never cast in bronze.

It was the clay model which was set up on the occasion of the marriage festivities of Bianca Maria Sforza and Maximilian, and Leonardo carried the conception no further. He had desired to cast it all in one piece and technical difficulty delayed the realisation of this, and very soon afterwards Ludovic Sforza's financial embarrassments became such that the cost of the bronze was prohibitive. The sentence 'of the horse I will say nothing because I know the times' occurs in the fragments of an undated letter to Ludovic in which Leonardo speaks of his own grave financial straits in having assistants to pay and maintain and not receiving his own salary.

While, however, causes over which Leonardo had no control operated finally to prevent the statue being cast in bronze, it is certain that they did not operate until at least twelve years had elapsed since his arrival in Milan, and during all this time if Leonardo had been ready to complete the work

'la voglia del Signor fu sempre pronta.'

Sabba da Castiglione has recorded the destruction of the clay model. 'I remember – and I cannot speak of it without grief and indignation – so noble and masterly a work made a target for the Gascon bowmen.' Vasari also says that when the French occupied Milan they destroyed it completely.

Whether, however, the event took place at the end of 1499

or on the re-entry of the French troops after the battle of Novara, the destruction was only partial, since in September 1501 the Duke of Ferrara wrote to his agent at Milan, Giovanni Valla, to ask him to obtain from the Cardinal of Rouen the model of the horse by Leonardo which Signor Ludovico intended to have cast, which he described as 'perishing daily for want of care.' In the reply the Cardinal is represented as having stated that while he personally was quite willing he had no authority to sanction the removal of the statue without the assent of Louis XII. There record leaves it.

Sabba da Castiglione, on whom the dignity of the statue of the horse made so deep an impression that he states that if it had been the only work done by Leonardo when in Milan it could not be said of him that he had wasted his time, laments that his works in painting while there were so few on account of his devotion to geometry, architecture and anatomy.

In fact a Nativity and a few portraits undertaken at the instance of Ludovic Sforza, a commission for an altar-piece at S. Francesco in which his name appears associated with that of Ambrogio de Predis, are all the works in painting executed after his migration to Milan of which any record holds previous to 1496, in which year he commenced to paint the Last Supper on the wall of the Refectory of S. Maria delle Grazie. The existence of a sketch for this subject, on the same sheet as various studies for the Adoration of the Magi, shows that this subject had been adumbrating in the mind of Leonardo since his Florentine years. Now that the opportunity offered for its execution he progressed so rapidly that the work was finished in about two years.

The Last Supper, even in its present ruined condition, affords as does no other work the most impressive example of what Leonardo's ideals in art really were. The absorption in cognate scientific studies perceptible in the Virgin of the Rocks, in the St. Jerome and the Adoration of the Magi which proved on occasion so dominant as to be the ultimate

undoing of the initial artistic purpose, is here seen wedded to it in perfect harmony. 'Farò una finzione,' says Leonardo, 'che significhera cose grandi.' That the structure is based throughout on mathematical calculations as in the four groups of the apostles is shown with convincing lucidity in the diagrams contained in Hoerth's Monograph on the picture. This symmetry emphasising the isolation of the central figure invests it with added power and significance. And art – consummate art – veils her processes. The symmetry does not obtrude. It is not on the surface. In Ghirlandaio's Cenacolo the details reek with it. Each of the apostles has his modicum of dessert awaiting him. Three cherries. No more and no less. With Leonardo there is no meticulous concern for these things. His figures are swayed by one impulse, and that a passion of the soul.

A painter, says Leonardo, has two objects to paint: man and the intention of his soul. The first is easy, the second hard, for he must represent it by means of the attitude of the limbs. So here it is a matter of expression communicated by details, but they are living details, such as the movement of the hand and shoulder, the turn of a wrist, the curve of a lip, the twisting corners of the mouth. It is by means of these instruments, and these alone, that the intention of the soul can find expression in the painter's art. Naturally therefore the table is somewhat bare; he leaves the counting out of cherries to those who are more interested than he is in decorative effects. How deeply he pondered over the problem of the action of the various characters may be seen most clearly from a passage in one of his notebooks in the Victoria and Albert Museum, in which he expresses tersely and succinctly what it is that he wishes to express in the attitudes of the figures.

'One who was drinking has left the glass in its position and turned his head towards the speaker. Another, twisting the fingers of his hands together, turns with stern brows to

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his companion. Another, with hands spread open and showing the palms, shrugs his shoulders up to his ears, and makes a mouth of astonishment. Another speaks into his neighbour's ear, and he who listens to him turns towards him and lends an ear, holding a knife in one hand, and in the other the bread half cut through by the knife. Another in turning, holding a knife in his hand, upsets with his hand a glass over the table. Another lays his hand on the table and is looking. Another breathes hard from full mouth. Another leans forward to see the speaker, shading his eyes with his hand. Another draws back behind the one who leans forward, and sees the speaker between the wall and the man who is leaning.'

Leonardo's aim was to produce the highest dramatic unity by natural action. 'Nature,' as he says, 'cannot break her own laws'; and in another passage, 'nature is constrained by the method of her law which lives and works within her.' It is unity in variety. The different actions, diverse according to the varying natures of the characters, all express the same emotion. The disciples are stirred by a single impulse of surprise arising from the words which have just been uttered by Christ:

'Verily I say unto you that one of you shall betray me.'

It is the truly dramatic self-revealing moment in the relation of Christ with his disciples. Once chosen, the artist became embued with its psychological possibilities, and by contrast with the vista there presented the earlier Florentine conceptions assumed almost a static quality. The traitor Judas is self-revealed. His fingers clutch the bag; his face is at once furtive and menacing. But he is not isolated in position, as in previous representations of the subject, nor is his treason as yet apparent to the others. They are in the first flush of wonder and amazement, and this, according to his precept, must be shown by the movement of the limbs.

In one other work, and one only, Leonardo set himself to represent a moment of dramatic intensity comparable to this, namely in the frenzy of combat of horses and men in the never completed and soon effaced 'Battle of Anghiari.'

Of the toil which preceded achievement, of the concentration of purpose, the hesitations, the pauses for thought which were toil after his fashion, we have a unique record in the testimony of an eye-witness, no less a person than Bandello, the nephew of the general of the Dominican Order, who at the time that Leonardo was at work at S. Maria delle Grazie was a youthful novitiate there. Over fifty years later, when Bishop of Agen, he handed over the government of the diocese to his neighbour of Grasse in order that he might have complete leisure to polish and arrange, and perhaps in some cases to write, his novels. His gift of narrative was never displayed with more graphic effect than in the picture he draws of Leonardo in the prologue to the fifty-eighth:

'It was his habit often and I have frequently seen and observed him to go early in the morning and mount upon the scaffolding as the Cenacolo is some distance from the ground; it was his habit, I say, from sunrise until dusk never to lay down his brush, but, forgetful alike of eating and drinking, to paint without intermission.

'At other times two, three, or four days would pass without his touching the fresco, but he would remain before it for an hour or two at a time merely looking at it, considering, examining and judging the figures.

'I have also seen him, as the caprice or whim took him, set out at midday, when the sun is in Leo, from the Corte Vecchia, where he was at work on the clay model of the great horse, and go straight to the Grazie and there mount on the scaffolding and take up his brush and give one or two touches to one of the figures and suddenly give up and go away again.'

The temperament of the artist as here revealed, and the aim of dramatic intensity which he set before himself, were

alike unfitted to the inelasticity of conditions which must necessarily govern fresco-painting, where such portion of the surface as had been prepared must be brought to completion on the same day. With a view to securing himself against this necessity Leonardo made use of an oil medium which, however, did not prove suitable to resist damp and the ravages of time. The evidence of the deterioration of the painting stretches back to the middle of the sixteenth century, and Vasari in 1568 testifies to it as having become a mere confused blur. Since then, by restorations almost numberless, it would seem that every scrap of the original colour must have been overlaid or flaked away.

It was Tintoretto who said 'beautiful colours are bought any day upon the Rialto, but a mastery of draughtsmanship only comes to study and night watches.'

Despite the ravage of time and the malice or witlessness of man the evidence of this remains. Henry James may be cited as a witness in a passage written primarily with reference to another ruin:

'In so far as beauty of structure is beauty of line and curve, balance and harmony of masses and dimensions, I have seldom relished it as deeply as on the grassy nave of some crumbling church, before lonely columns and empty windows, where the wild flowers were a cornice and the sailing clouds a roof. The arts certainly have a common element. These hoary relics of Glastonbury reminded me in their broken eloquence of one of the other great ruins of the world – the Last Supper of Leonardo. A beautiful shadow in each case is all that remains, but that shadow is the artist's thought.'

In the new-found confidence in his power to execute occasioned by the completion of the work in Santa Maria delle Grazie Leonardo addressed himself again to the problem of the casting of the Sforza statue. We find him consulting the mathematician Fra Luca Pacioli as to calculations of height

and weight. But the favourable moment had now passed by. Ludovic had already drained his resources in the enormous subsidies with which he had endeavoured to buy off enmities, and the expense of the bronze for so colossal an undertaking had become an insuperable difficulty. Early in 1499 he was constrained to give Leonardo a vineyard of sixteen perches outside the Porta Vercellina in payment of amounts due to him.

His tenure of the duchy had become in the highest degree precarious as soon as Louis XII decided to revive the claim of the Visconti succession as vested in his family. Opportunities of court employment were restricted to those connected with the impending danger, and as Leonardo was created 'ingegnere camerale' at this time, it is natural to infer that his knowledge was put to some practical use in supervising the repair of fortifications. – He busied himself also more and more with those more congenial studies and researches from which he had been severed by the exigencies of official duties. With Fra Luca Pacioli, for whose treatise, *De Divina Proportione*, he had drawn the figures sixty in number, he was in constant association in mathematical research.

In the dedication to Ludovic of *De Divina Proportione*, Pacioli mentions the fact of a concourse of the most learned and illustrious men 'lo laudabile e scientifico duello' held in February 1498, at which the Duke had been present, and signalises the fact of Leonardo's presence there with special epithets of distinction. This statement, in conjunction with the existence of seven sheets of drawings in which in the centre of a maze-like arrangement of interlacing lines is found the inscription 'Achademia Leonardi Vici,' has been quoted in proof of the actual existence of such an institution presided over by Leonardo. But, as Uzielli has said, it is quite inconceivable that in this case there would be no other reference to the fact of its existence. Pacioli's statement may be interpreted in its most natural meaning as having reference

to a particular discussion akin no doubt to some in which Leonardo participated when in Florence.

The inscription on the drawings is no proof of the actual existence of such an Academy. The design needed a centre-piece, and Leonardo, 'discipolo della sperienza,' as he styles himself in another place, was perhaps somewhat addicted to phrase-making and liked the turn of the phrase.

Solmi, who thinks the sheets may have been intended to form part of a geometrical game, says very aptly that no one would have been less suited to run an Academy than Leonardo. He desired to study everything that an academy of arts and sciences could teach, and as far as was practicable he did so, but it would have been quite another matter to undertake the work of the organisation of such a body or to preside over its sittings. For this he was too much the student.

Sabba da Castiglione, who witnessed the destruction of the Sforza statue, has stated that the reason why few other works in painting by Leonardo beside the Last Supper were to be seen in Milan was because 'when he ought to have attended to painting in which no doubt he would have proved a new Apelles he gave himself entirely to geometry, architecture, and anatomy.'

From the year 1496, when Fra Luca Pacioli had been invited to Milan by Ludovic, there is continual evidence of Leonardo's collaboration with him in mathematical researches. He refers in his manuscripts to learning from him the multiplication of roots. The two worked together at the problems of Pacioli's book for which Leonardo made the illustrations, and in the dedication Leonardo is referred to as architect, engineer, inventor and artist, in terms which show deep admiration, respect, and intimate friendship:

> 'in conpagnia deli perspicacissimi architecti e ingegnerii e di cose nuove assidui inventori Leonardo da Venci nostro conpatriota fiorentino, qual de scultura, getto e pictura con ciascuno el cognome verifica.'

In these researches Leonardo continued unmoved when all around him was in political turmoil.

At the beginning of August 1499 the French army of invasion was already gathering at Asti, and Trivulzio had been appointed to command it; Ludovic meanwhile was making feverish attempts to organise resistance. There is an entry of this date on a page of the Codice Atlantico: 'On the first day of August 1499 I wrote here of motion and weight.' The Milanese fortresses fell rapidly until at the end of August Galeazzo di Sanseverino, retreating from Alessandria, found the gates of Pavia closed against him. On the second of September Ludovic retreated from Milan to go to Innsbruck, where he had already sent his two sons and where he intended to collect an army with the help of the Emperor Maximilian. He left behind him a strong force under Bernardino da Corte to hold the Castle, which was deemed impregnable, but which was surrendered almost immediately for a bribe by its commandant.

Two months afterwards Leonardo, accompanied by Fra Luca Pacioli, left Milan, and the two friends proceeded by way of Mantua to Venice.

To the ruler exile means the loss of all: artist and thinker take their sovereignty with them.

A new-found sense of freedom seems to attach to Leonardo's movements after his leaving Milan – freedom to follow the dictates of his own nature.

Staying at Mantua only long enough for Leonardo to make a drawing of the Marchioness Isabella d'Este – this being the beautiful red-chalk drawing in the Vallardi Collection in the Louvre – the two friends passed on to Venice, Leonardo to be followed in course of time by a letter from her who for her wit and grace was styled 'la prima donna del mondo,' pathetic almost in its insistence that he should remember the promise he made when at Mantua that he would one day paint her portrait. At Venice they remained for some months, and on the strength of two references in the Leicester manuscript to the amount of the variation of the tide at Venice Solmi supposes that Leonardo's time was spent in part in solitary rambles on the shore of the Adriatic, but as in the Leicester manuscript 'on the nature, weight and motion of water' Leonardo in the two passages referred to is comparing the different conditions of the tide in different places and cites also as instances Tunis in the one case and in the other Genoa and the channel between England and Flanders, and as in the calculation of the height of the tide in the English Channel he must be speaking from literary knowledge, and in the case of Tunis almost as certainly, it is natural to regard the calculations as founded in each case on literary knowledge rather than on actual observation.

That love of solitude and the resultant liberty to think which impelled the words 'quando tu sarai solo tu sarai tutto tuo' had led him to wander in the hill-country of Tuscany and Lombardy and also of the Veneto; but here it was with a more practical purpose, because Venice had need at the moment of services such as Leonardo alone could offer. Ludovic Sforza in the last and most tortuous period of his

diplomacy, stung by the news that Venice had allied herself with France and had been promised the Milanese territory of Cremona and Ghiara d'Adda as the price of her perfidy, had incited the Turks to renew the war against Venice, and at the same time as Ludovic Sforza had fled as an exile and Louis XII had entered Milan, the governor of Bosnia, Scander Bassa, had with his cavalry invaded the Veneto and ravaged it as far as the Livenza and then retreated massacring most of his prisoners. Leonardo and Pacioli reached Venice just at the period when, as Horatio Brown says, 'the Turks were burning the homesteads of Friuli and their fires could be seen from the campanile of St. Mark.'

By sea the danger was no less. It had been the naval victory of Zonchio which had emboldened the Turks to the invasion of Friuli. Kemal-Reis, the first great Turkish admiral, was then at the zenith of his career. In August 1499 he had completely defeated the Venetian fleet under Grimani in a series of battles off the island of Sapienza, thereby bringing about the fall of Lepanto and the capture of many prisoners, and when the republic had sent an ambassador to treat for the release of the prisoners all he had gained from the Grand Vizier was the reply to tell the Doge that he had done wedding the sea, for it was their turn.

'Venezia l'ha sposato el mar fin adesso; per l'avenir tocherà a noi, che habbiamo in mar più di voi.' By sea therefore as by land the outlook for the Venetian Republic was entirely favourable for the exercise of such talents as those of which Leonardo had offered to make trial in his letter to Ludovic Sforza. That he did in fact consider the problem of land defence is shown by certain references in the manuscripts to places in the Veneto, and more particularly in Friuli.

The Turks had retreated, doing as much damage as possible. The problem which Leonardo set himself to tackle was how in future to prevent such incursions. The method he proposed was to prepare to flood the country when necessary against the invader, as at a later period the Dutch defended

their independence by opening the dikes and letting in the sea, and for this purpose he proposed to erect a great dam with sluices on the Isonzo at Gorizia. On a page of the Codice Atlantico, fol. 234b, there is a note 'Bridge of Gorizia – Vilpago,' and accompanying it a sketch of a bridge; and he has indicated apparently in a few strokes the course of the Isonzo and its tributary the Wippach.

Two passages on the same page form apparently part of an official memorandum, the second being the key that unlocks the meaning of the whole:

'I am of opinion that it is not possible to construct a defence in any other spot which would be of such universal efficacy as one made over this river.'

'Having, O most illustrious Lords, thoroughly examined the nature of the river Isonzo, and having ascertained from the inhabitants of the district that from whatever part of the mainland the Turks approach the gates of Italy they must arrive at this river, for this reason I am of the opinion that even over this river it is not possible to make defences which will not in the end be ruined and destroyed by the floods.'

There is a further reference in a passage written during Leonardo's residence in France in the British Museum MS. Arundel 263, fol. 270b. He is there giving details of a scheme of irrigation to be made by turning an affluent of the Loire into the river of Romorantin and says, 'and let the sluice be movable, like the one that I arranged in Friuli, in which when one sluice-gate was open the water which passed through it hollowed out the bottom.'

The word 'ordinai' which, following Dr. Richter, I have translated by 'arranged,' although not specifically indicating actual construction, is quite consistent with it, but in the absence of more direct evidence we must agree with Solmi that it cannot be affirmed that the plan was ever translated from theory to fact.

Of Leonardo's ability to construct such a sluice there can

be no question. He had been employed in Lombardy in irrigation schemes in the Lomellina and in connection with the Martesana Canal, and a few years after this time his name appears as one of a commission sent by the Signoria of Florence to study a plan for diverting the course of the Arno in order to cut it off from Pisa. The Council of Venice may, however, have doubted either his constructive capacity or the efficacy of the scheme for the purpose for which it was conceived, and Leonardo could not well offer, as he did in the letter to Ludovic Sforza, 'to make trial of them in your park or in whatever place shall please your Excellency.'

A sentence in one of his manuscripts of about this time, 'cannon at Venice, after the manner that I suggested at Gradisca,' C.A. fol. 79r, shows that Leonardo, when travelling in Friuli to study the problems of defence, visited Gradisca and used his knowledge of artillery to devise improvements in the fortifications of one of the most important of the border fortresses.

It may therefore be concluded that while at Venice he studied the problem of land defence and proffered his services as an engineer.

Solmi and Beltrami seek also to connect with this period various references in the manuscripts to plans for naval warfare and for diving, Solmi's theory being that when Leonardo discovered the political situation at Venice he suddenly conceived the idea of using his diving inventions to cause damage to the Turkish ports, to sink the Turkish fleet and at the same time to free the Venetian prisoners. That in the opinion of Solmi Leonardo should think to accomplish the two latter objects by one operation is an instance of how a theory may dominate its author. Whereas in the passages from Leonardo's writings which relate to land warfare, to which reference has been made, the place indications are clear and circumstantial, in those which have to do with sea warfare they are entirely absent.

There are in the manuscripts various sketches of diving

apparatus, accompanied by detailed notes. In some of these the diver has a connection with the air by means of a tube and float, and he refers to the use of this model by the Indians engaged in the pearl and coral fisheries; Leonardo's aim apparently was to invent an apparatus which should give the diver greater freedom and a wider range of action, and he proposed to make him independent of the air above by equipping him with a bag or reservoir of air. In one of the drawings, C.A. 346v.a, there is a vice or drill which can be worked by the diver and which conceivably, although not necessarily, points to the intention to use the mechanism for a warlike purpose. Among the notes accompanying another drawing, C.A. 333v., in which the diver is represented fully dressed, is the instruction that he should carry a sharp cutting knife to guard against being taken in a net. In another of the notes on this page Solmi finds the preparations for the culminating act of the drama – the rescue of the prisoners. It is this passage which Boratta, who has made a careful study of all Leonardo's notes of diving apparatus, characterizes as written with mysterious secrecy, and while the precise meaning of the words is to me obscure they seem to show that some military purpose was adumbrating in his mind in connection with the use of a diving apparatus.

Beltrami, who concurs with Solmi in connecting these passages with the war between Venice and Turkey, quotes the phrase 'delle nostre parti italiche' in immediate connection with a sentence of Leonardo about smashing ships in the keel and sinking them with the men who were inside, adding that this was because it was necessary for the defence 'delle nostre parti italiche' 'of our Italian lands.' This would serve to show that Leonardo did contemplate and prepare for the use in naval warfare of the invention to smash ships in the keel and sink their crews to which reference has been made. But this sentence occurs in the Leicester MS., fol. 22b, in which Leonardo is discussing methods of remaining and moving in water, and after referring to the natural move-

ments of living creatures he mentions the existence of a machine by which many people may stay some time under water, and will not describe the method of it because the evil nature of man is such that it would be used as a means of destruction, namely by assassinations at the bottom of the sea, by smashing ships in the keel and sinking them, together with the men who are in them. The passage in which the words '*alle* nostre parti italiche' occur (C.A. 234b) has no reference to naval operations, but is where Leonardo is explaining the route which must be taken by the Turks in approaching Italy 'alle nostre parti italiche' by land, namely that they must cross the Isonzo. In the absence of either place or time references in the passages which relate to diving apparatus and submarine warfare, the particular occasion, if any, for which they were designed must remain at best a matter of conjecture. Calvi, in his recent study of the Leonardo manuscripts, has advanced a series of reasons which merit very careful consideration why the sheets on which these particular passages occur should be looked upon as having once formed part of a Milanese register and as having been written at an earlier date than the period of Leonardo's residence in Venice. He would by preference refer them either to the years 1483 and 1484, when the Duke of Milan was leagued against Venice in the war of Ferrara, in which case they were designed, not on behalf of Venice, but as a means of attacking her, or to the year 1487 when Milan had annexed Liguria and with it had assumed maritime responsibilities. In the absence, however, of any evidence of actual use the question of the occasion for which plans were prepared is of relatively small import as compared with the insight into the constructive imagination of Leonardo which these plans afford.

The trend of events in Milan in the spring of the year 1500 was instrumental probably in putting a term to Leonardo's stay in Venice. Ludovic Sforza, after four months of exile, returned to renew the struggle for the duchy with the help of a German Swiss army. During the interval the

licence of the French soldiery and the exactions of their new rulers had proved insupportable to Milan, and as soon as the rumour of Ludovic's coming grew definite all Lombardy rose in revolt against the French. Trivulzio on the 3rd of February retreated with the French troops to Novara, and two days later Ludovic was back in his capital. By the end of the month only the castle of Milan, Novara and Mortara remained to the French in Italy. But the French army was undefeated and strong reinforcements were on the way to join it. Ludovic captured Novara on the 22nd of March, and this was his last success. When the reinforced French army, containing many Swiss mercenaries, advanced to Novara to attack Ludovic his Swiss troops refused to fight against their own countrymen, and his army of Germans and Swiss melted away, each seeking a safe-conduct home from the enemy's commander. Ludovic Sforza, donning the disguise of a Swiss pikeman, was captured, as was said, by treachery, and with his departure to France as a prisoner on the 17th of April the short-lived hopes of a restoration of the Sforzas were ended.

On Leonardo in Venice the news of these events fell like a thunderbolt. He has written on the cover of one of his manuscripts (MS. L) a series of brief notes referring to events in Milan at this period – a record, enigmatic yet eloquent, of disasters to places and persons, the last serving as his patron's epitaph: 'The upper room with the apostles. The pen keeps company with the penknife, the one can do nothing without the other. Buildings of Bramante. The governor of the castle made prisoner. Visconti dragged along the ground and his son slain. Giovanni da Rosate robbed of his money. Borgonzio would and would not and then fortune fled. The Duke has lost the State, his possessions and his liberty, and has seen none of his works completed.'

By the 24th of April Leonardo had gone to Florence, for on that day he drew out some of the money which he had deposited in the hospital there. His return was, from the Florentine point of view, the return of one of their leading

artists. If the few works which he had executed in his youthful period in Florence did not fully establish this it was most evident from his career in Milan. The fame of his statue of Francesco Sforza had spread through Italy – the tributes of the poets assure us of this – and Florence was the city where the sculptor's art was most regarded. In painting the fresco of the Last Supper he had shown once and for all what he could accomplish. The art world of Florence had suffered by death and the lure of Papal commissions in the Vatican, and there were far fewer painters there of the first rank in the year 1500 than when Leonardo went away.

His return in mid-career in the plenitude of power, before in the ordinary course of years the hand had weakened, gave them the opportunity of enriching the city with the products of his genius.

So, as Vasari tells us, when Leonardo said, à propos of a commission for an altar-piece given to Filippino Lippi by the monks of the Annunziata, that he would have been very willing to do it himself, the all-important fact was immediately communicated to Filippino, who obligingly withdrew from the commission, which was then given by the monks to Leonardo. He spent a long time making preliminary studies – but that was his way. However, when the cartoon with the Madonna, St. Anne and the infant Christ was prepared, the Florentine mind knew that it had been right in its anticipation, and Vasari has graphically recorded the traditional memories of how Florence had welcomed the fact. 'When it was finished,' he says, 'the chamber wherein it stood was crowded for two days by men and women, old and young; a concourse, in short, such as one sees flocking to the most solemn festivals, all hastening to behold the wonders produced by Leonardo.' The cartoon in black chalk now in the Diploma Gallery at Burlington House – although from the absence of a lamb it does not correspond either with Vasari's description or with that of Fra Pietro da Nuvolaria and cannot therefore be considered to be the cartoon in question, but

only a variant of the composition – has preserved many of the characteristic features, the softness and grace, the delicacy and sensitiveness of modelling of what was the ripest period of Leonardo's art. Fra Pietro's description is due to the pertinacity of Isabella d'Este, whose interest in Leonardo's work, of which the earliest record is her request to Cecilia Gallerani to lend her her portrait in order to compare it with a Bellini, was intensified after his visit to Mantua, and found expression between the years 1501 and 1506 in letters to various persons, of whom the Vicar-General of the Carmelites was the first, to induce them if possible to persuade Leonardo to let her have some specimen of his art. The first letter written in reply, which is dated 3 April 1501, contains a full description of the cartoon which, according to Vasari, all Florence was then flocking to see. We may discern from it how straitly Leonardo interpreted for himself his precept that the purpose of the painter must be to depict natural action. 'It represents,' he says, 'Christ as a child of about a year old stretching almost out of his mother's arms and seizing a lamb and apparently about to embrace it. His mother, half rising from the lap of St. Anne, seizes the child to pull it away from the lamb – a sacrificial animal which indicates the Passion. – St. Anne half rising from her seat seems to wish to keep her daughter from pulling the child away from the lamb, this being perhaps intended to represent the Church which would not wish the Passion of Christ to be hindered.' The second letter is only a day later in date, but before writing it Fra Pietro had been to see Leonardo, who had given him a somewhat elusive because conditional promise. He describes a small picture which Leonardo had just finished for one Robertet, a favourite of the King of France, in which the Madonna is sitting at work with a spindle and the Infant Christ is looking intently at four rays of light which fall in the form of a cross – a motive which occurs in 'The Carpenter's Shop' of Millais, where the cross is formed by the shadows cast by two planks of wood. – In somewhat curious

contrast to these descriptions of pictures which have stirred the enthusiasm of the writer is a sentence almost identical in purport in the two letters, but with some additional emphasis in the second. In it the trend of Leonardo's mind at this time is clearly indicated. In the first it runs, 'he is working hard at geometry and is very impatient of painting' 'impacientissimo al pennello'; in the second letter, written only a day later, but after he has seen and talked with Leonardo, he says, 'in short his mathematical experiments have so estranged him from painting that he cannot bear to take up a brush' 'che non può patire il pennello'. Such being his thought thus freely expressed it is small wonder that the often reiterated desire of Isabella d'Este remained unsatisfied. Florence had looked to welcome the artist, but the manner of the ending of Leonardo's life at Milan seems to have brought about a severance for a time from artistic purposes, and there had been a natural quickening of his interest in mathematical research from the fact of his association with Fra Luca Pacioli at Milan during the last three years, at Venice, and at Florence, where, as Pacioli states in his *De Divina Proportione*, the two lived together.

To Leonardo, not now if ever primarily the artist striving to create, but rather the thinker and student anxious above all to know, the return to Florence afforded an opportunity of retreading interrupted paths of knowledge. To this period may be attributed some of those many anatomies which, according to the Anonimo Gaddiano, he drew in the Hospital of Santa Maria Nuova.

A page of notes in the Codice Atlantico, which may be ascribed to this period from the multiplicity of Florentine allusions, reveals something of his interests at this time and might serve to illustrate a remark in Fra Pietro da Nuvolaria's first letter 'la vita di Leonardo è varia et indeterminata forte, si che pare vivere a giornata.' Half the entries seem mere tags for memory of the daily occurrences and necessaries, set down in strange juxtaposition with the memo-

randa of his studies, of how he borrowed books, used libraries, moved about in the world of ideas of Florence and yet lived in a world apart:

'Pandolfino's book – knives – pen for ruling – to have the vest dyed – Library of St. Mark – Library of Santo Spirito – the Daldi's copy of Lactantius – Antonio Covoni – a book by Messer Paolo Infermieri – boots, shoes and hose – varnish – an apprentice to do the model for me – grammar of Lorenzo de' Medici (this being presumably Lorenzo di Piero) – Giovanni del Sodo (a mathematician) – Sansovino (the sculptor) – a ruler – a very sharp knife – spectacles –

'Tommaso's book – a small chain of Michelangelo (not the artist but a goldsmith of that name) – learn the multiplication of roots from Messer Luca – my map of the world which Giovanni Benci has – socks – clothes from the customs' official – red Spanish leather – map of the world of Giovanni Benci – a print of the districts round Milan – book for marketing.'

An elusive list this for any student of personality! Try how you will, it does not abide your questioning. It seems and is a jostling together of names and things incongruous, – some practical, some trivial – with mention of people for the most part of importance in their day who are now dead even to memory, and just here and there a vista through avenues that open out and show where his mind found pasturage!

THE ROMAGNA

SUDDENLY, by a turn, as it were, of a zoetrope, the picture changes and the scenes of study in library and studio fade away. Of that commission for the Annunziata which Filippino Lippi had yielded up to him nothing had ever been done except the cartoon. We find Leonardo in the Romagna in the service of one of the most dazzling and extraordinary adventurers who ever crossed the stage of Italy. Cæsar Borgia shares with his father, Alexander VI, the distinction of being one of the two most utterly shameless figures in the Renaissance. The crimes of each were flagrant and calculated, but whereas those of the Pope have such measure of palliation as may spring from the fact that they were committed primarily to advance the interests of his children, in the case of Cæsar Borgia they were for self and self only. Cardinal at the age of seventeen and then released from his vows because, as the Pope naïvely said, he did not show sufficient aptitude for the spiritual life, he had gone to France as bearer to Louis XII of the permission for the divorce which the King desired, and had returned with the title of Duke of Valentinois and with a French wife and a French duchy as her dower. He had ridden into Milan in attendance on the King when, on the sixth of October, 1499, Louis XII made his triumphal entry. Baldassare Castiglione, who witnessed the ceremony, has described his gallant bearing and the splendour of his equippage. Leonardo remained in Milan for upwards of two months after the entry of the French, and he may very possibly have there met Cæsar Borgia. Uzielli's suggestion that the proposal that he should enter his service originated at this time seems improbable because the Romagna was yet to be won. To this end he hurried away with such help of French forces as Louis would give him, and had already struck his first blow by the capture of Imola before Leonardo left Milan. Foiled in more ambitious schemes for establishing his son among the territorial rulers of Italy, Alexander VI had proclaimed the ejectment of all

the lords of the lesser states along the Adriatic coast which formed the fiefs of the Church each under the rule of its hereditary tyrant or lord, and by creating Cæsar Borgia Gonfalonier of the Church to enforce the sentence he had given him the opportunity of winning a principality for himself. This he proceeded to do in a series of campaigns which, stamped as they were with instances of ruthless cruelty and premeditated treachery, yet revealed qualities which placed him in the front rank as a military tactician. These, together with his capacity as an administrator in his conquered territories, so impressed Machiavelli, who was sent to his court as an embassy from Florence, that finding that, as he says, 'the Borgia neither use half measures nor halt half-way in their undertaking,' and believing that 'to have freedom the people must also have strength,' he was, for a time at any rate, disposed to regard him as the one strong man from whom the deliverance of Italy from foreign domination might conceivably have come. In less than four years from the capture of Imola, which marked the opening of his first campaign, the death of Alexander VI occurred to reveal on how insecure a basis his power really rested; but in two campaigns his forces had swept all the rulers of the Romagna from their seats. He held Piombino, Siena, Arezzo, Urbino, and was only prevented from seizing Bologna and further strengthening his hold on Tuscany by fear of rousing the hostility of France, which, at first an ally, had come to look with apprehension on any further extension of the area of Cæsar Borgia's power.

Time references of a quite definite character enable us to contract the episode of Leonardo's connection with Cæsar Borgia's fortunes within comparatively narrow limits. Early in May 1502 he was consulted by one of Isabella d'Este's correspondents in Florence, Francesco Malatesta, as to the value of certain vases. The fact of his having returned there ten months later is shown by his having, on the fourth of March 1503 drawn out fifty florins from the amount which he had deposited in the Hospital of S. Maria Nuova.

It is of significance also as fixing the duration of his stay in the Romagna that all the dated references to places there in Leonardo's manuscripts fall between these two dates. They show his presence in Urbino on the thirtieth of July 1502, at Pesaro on the first of August, Rimini on the eighth, Cesena in the middle of the month, and at Porto Cesenatico on the sixth of September. The undated place references to the Romagna may therefore naturally be interpreted to belong to the same period. Among these are three references to Piombino, a note of a method of drying the marsh, perhaps in order to facilitate the passage of troops, a sketch of a wave with a note 'made by the sea at Piombino,' and a description of the devastating effects of a tempest there. It is a curious coincidence that there is also an account of a violent tempest which separated the ships in the record of the journey of inspection made to Piombino in February 1502 by Cæsar Borgia and Alexander VI. Yriarte, who believes that Leonardo was then present as a member of Cæsar Borgia's household, regards it also as probable that his talents as a military engineer were employed in the siege of Piombino, which had capitulated to Cæsar Borgia's forces in September of the previous year. But a fact is a rock that abides amid a sea of conjectures, and unless we are to suppose two visits to the Romagna with a return to Florence between them, of which there is no evidence, we must conclude that his visit to the Romagna was subsequent to his valuing of vases in Florence, and therefore that it did not commence before the middle of May 1502.

Cæsar Borgia was then in Rome preparing in a leisurely manner for his third campaign. His power was at its zenith. All the Romagna had acknowledged his sovereignty. Arezzo had fallen to his lieutenant Vitellozzo. Pisa had offered herself to him on the single condition that he would never be at peace with Florence. Setting out with his army on the twelfth of June, ostensibly to reduce Camerino, he asked as a favour from Guidobaldo, Duke of Urbino, the

loan of some of his artillery and a passage for his troops through his territory. On reaching Spoleto, however, he suddenly marched his forces to attack Urbino itself. Resistance being quite out of the question the Duke escaped with difficulty by a midnight flight, and eventually reached Mantua. A few hours after his flight Cæsar Borgia installed himself at Urbino in the palace of the Montefeltri.

Such unexampled perfidy naturally intensified the alarm with which Cæsar Borgia's operations were viewed by the surrounding states, and in August, wishing apparently to safeguard his position from any recriminations by the dispossessed rulers, he travelled post-haste to Milan, where Louis XII then was, and was there received by the King with every possible mark of favour. When Louis XII left Milan to proceed to Genoa, Cæsar Borgia accompanied him as far as Pavia, and it was there on the eighteenth of August 1502 that he signed the letters patent of authority to Leonardo, referring to him as 'our most excellent and well-beloved servant, architect and engineer-in-chief Leonardo da Vinci' whom he has appointed to inspect fortresses in his dominions with a view to their repair wherever he may consider it necessary, – bidding all his lieutenants, officials and subjects afford him every facility in such inspection to examine and take measurements, and any assistance in men that he may desire, enjoining also upon every engineer who shall carry out work in his dominions that he shall confer with Leonardo and follow his instructions under pain of incurring the writer's most severe displeasure. Cæsar Borgia's resolve to order an inspection of the fortresses of his state as a preliminary measure for their defence was probably, as Beltrami suggests, the immediate consequence of his meeting with the King of France at Milan. It does not fix the date at which Leonardo entered his service. This was probably some two months previously. A sketch in MS. L with a note 'pigeon house at Urbino the 30th of July 1502' shows his presence in the city which Cæsar Borgia had made his

headquarters since his troops first occupied it on the 21st of June. There he may have seen and studied, before the troops started to remove the treasures of Guidobaldo's library to Rome, that copy of Archimedes of which he states in the Codice Atlantico 349v. 'era prima nella libreria del duca d'Urbino, fu tolto al tempo del duca Valentino.'

The position which the letters patent reveal Leonardo as holding at this time at the court of Cæsar Borgia was not dissimilar in scope to that which he had solicited twenty years previously in Milan, and both there and in the territory of Venice, as his manuscripts show, he had been busy in the study of problems of defence. Of his fitness as far as study could prepare him for the duties of the post to which he was appointed they offer abundant evidence. With Valturio's *De re militari* as his textbook, with a professor of strategy such as Pietro Monti, a captain of bowmen like Biagino Crivelli as his mentors he studied the science of warfare with all possible thoroughness, and the results are seen in many drawings with accompanying notes treating of weapons, of new devices for warfare and the art of fortification, the last forming a considerable section of his architectural studies. Three days subsequent to the occupation of Urbino by Cæsar Borgia's forces a Florentine legation sent at his request to confer with him arrived there. It consisted of Francesco Soderini, Bishop of Volterra, with Machiavelli as his secretary, and although the latter returned after a few days to make a report to the Signoria, who were alarmed at the progress of events and the capture of Arezzo, it may have been, as Solmi suggests, that the author of the 'Art of War' then and there met and conferred with Leonardo, for whom he drew up a year later the historical account of the battle of Anghiari for use in the composition of his picture for the wall of the Palazzo della Signoria.

It is a fact not perhaps altogether devoid of significance that none of the four dated notes in Leonardo's manuscripts which attest his presence in the Romagna before the eight-

eenth of August 1502 – the date of the letters patent – have any connection with the duties of the post there referred to. At Urbino on the thirtieth of July he made a sketch of a pigeon house, at Pesaro on the first of August a memorandum of a visit to the Library, at Rimini a week later the spectacle of the different falls of the water as seen in the fountain suggested to him the thought of a harmony constituted in such a manner. The fourth note is a slight sketch of the façade of a palace inscribed 'on St. Mary's day in the middle of August, at Cesena, 1502.' On the other hand, the contents of the only dated note in the manuscripts connected with the Romagna which is later than the letters patent is entirely germane to the duties of the office there referred to, namely that of inspecting fortresses. The text, which is accompanied by a slight sketch, runs: 'at Porto Cesenatico on the sixth day of September at nine a.m. – the way in which bastions ought to project beyond the walls of the towers in order to protect the outer ramparts so that they may not be taken by the artillery.' The difference between this and the tenor of the earlier dated notes of the Romagna period is sufficient to justify the assumption that the date of the letters patent marks the inception of Leonardo's employment as military engineer in the service of Cæsar Borgia. The idea of so employing him was probably a direct result of the conversations which took place between Cæsar Borgia and Louis XII, during the time that elapsed between Cæsar Borgia's sudden journey to see the King at Milan and the signing of the letters patent at Pavia twelve days later.

The military situation as created by Cæsar Borgia's repeated aggressions was then reviewed, and measures for the future outlined, and so while in the letters patent Leonardo is styled architect and engineer-in-chief in the Duke's service, the provisions relate only to his appointment to inspect fortresses. Brief notes in various pages in MS. L of a very varied nature, for the most part with sketches accompanying of things seen in the neighbourhood of Cesena, e.g.

'windows at Cesena,' 'a cart from Cesena,' 'the way grapes are carried at Cesena,' 'the rock of Cesena,' 'the rock of the harbour of Cesena is four points south-west from Cesena,' show that this city which Cæsar Borgia made his capital was Leonardo's headquarters for some time. According to Alvisi and Yriarte he is to be credited with the construction of the navigable canal which runs from Cesena to Porto Cesenatico, and the observations as to the position of the rock of the harbour of Cesena may perhaps be connected with this project. MS. L also contains a small ground plan of the fortress of Urbino, and various notes and sketches of the steps of the palace of Urbino and how the plinth should be as broad as the thickness of the wall against which it is built, referring either to architectural work upon which Leonardo was engaged or memoranda of details in which he was interested. Two references show that he visited Siena and there studied the mechanism of the bell of the Cathedral, noting the manner of its movement and the position of the clapper. The interest in acoustics shown here and in the projected harmony made up of different falls of water led him to note how at the base of the Apennines the shepherds of the Romagna make large cavities in the mountains in the shape of a horn and then by fastening a horn to one side so that it joins on to the cavity are able by blowing to produce a tremendous sound. In yet another passage in MS. L which refers to the Romagna there is perhaps a personal note such as is rarely found in his manuscripts. He is describing a type of four-wheeled cart as very uncomfortable to travel in because the two front wheels which bear most of the weight are small and the back ones large, and says they are used in Romagna 'capo d'ogni grossezza d'ingegno,' or as Richter phrases it, 'realm of all stupidity.'

The treachery of Cæsar Borgia's methods as exemplified by his occupation of Urbino may perhaps furnish a reason why within six weeks of the date of Leonardo's appointment to inspect fortresses the Duke was faced with a concerted

revolt of his condottieri, and out of all his fortresses in the Romagna scarce one remained to him except his first conquest, Imola, where during the whole of the month of October 1502 he was virtually in a state of siege. That Leonardo was there with him at this time is to be inferred from the fact that among the Leonardo MSS. in the Royal Library at Windsor is a very elaborate map of the town of Imola in which Leonardo has indicated with great precision of detail streets and houses, walls and fortifications, the encircling moat, the winding of the river and the roads of approach through the surrounding country, and has stated in the margin and also on a page of MS. L the distances that separate Imola from the surrounding towns and the exact direction in which these lie. Timely help from Louis XII and the outbreak of some disunion among the condottieri relieved the situation somewhat for Cæsar Borgia, and there followed the partial accord with the condottieri, and on the last day of the year the crowning duplicity of Sinigallia and the doom there meted out to the victims. Cæsar Borgia had left Imola early in December for Forli and from there he went to Cesena, and Leonardo may have gone there with him. The Duke's fortunes were again in the ascendant after he had got rid of the conspirators. In January 1503 Perugia and Città di Castello submitted to his rule. The remnant of the rebels had collected at Céri and there in March and part of April he besieged them, according to Yriarte, 'with help of new engines invented by Leonardo da Vinci.' Whether this was or was not the case it is certain that Leonardo was not present at the siege, for by the fifth of March 1503 he was already back in Florence, having, as records show, drawn out a sum of money on that date from his account at the hospital.

Machiavelli, in one of his despatches from the Romagna written on the ninth of October 1502, stated that 'the Duke has so much artillery and in such good order that of himself he possesses almost as much as all Italy.' In view of the

nature of the duties which would follow from Leonardo's appointment it is reasonable to infer that he was in part responsible for this state of things. If comparatively few of the passages in his manuscripts which show his presence in the Romagna have any direct connection with his official duties either as architect or engineer it is that the manuscripts are not official reports, and do not therefore necessarily contain any references to his official duties. They are notebooks in the most exact sense of the words, and Leonardo wrote in them at his pleasure just what he thought fit. In the sustained record which they present of the activities of his mind they may and often do offer clues for the archivist, but from their very nature they are elusive and incomplete. A few notes occurring in them suggest his presence further south than any yet recorded. A list of places in MS. L, beginning with Buonconvento to the south-east of Siena and extending by a line slightly south of east through Casa Nova, Chiusi, Perugia and Assisi to Foligno, the distances of the first two stages being given in miles, must evidently refer to a journey undertaken or projected from Siena to Foligno. A note in MS. L, 'Acquapendente is near Orvieto,' if as is probable it is a record of travel, suggests that the writer is on the way to Rome.

When exactly Leonardo left Cæsar Borgia's service is a matter of conjecture. He was probably with him at Imola, he may have gone with him to Forli and Cesena, and been present, as was Machiavelli at Sinigallia, when the Duke trapped the conspirators, and then accompanied him to Rome. Or it may be that between November 1502 and February 1503 he was travelling in the Romagna busied with the duties of his office as inspector of fortresses. And then it ended. And how? Did Florence suddenly become a magnet that drew him to her? Did Soderini send offers of employment in the service of the Signoria? And the Romagna 'realm of all stupidity' 'capo d'ogni grossezza d'ingegno' with its pinchbeck Cæsar, fratricide and voluptuary,

suddenly become unendurable? Machiavelli, before whose eyes floated the vision of a united Italy, discerned in Cæsar such strenuous purpose and will to mastery that he could put all else aside and think of him as a prince-reformer, but when, after the bubble of his power had burst, Machiavelli wrote the *Decenniale Primo* the Duke and his condottieri are characterized as a brood of venomous serpents tearing each other to pieces, the Duke being the basilisk who lures the rest to his lair. Leonardo, who was the sterner moralist, never exalted Cæsar Borgia. He did not think in terms of statecraft, and Italy under one ruler was utterly beyond his vision. As in the letter to Ludovic so in entering Cæsar Borgia's service, he looked primarily for the opportunity of testing some of his inventions, of putting his powers to the proof in an entirely practical way. And to this the course of events proved adverse. There never was the requisite sense of security. The fortresses which Leonardo had to inspect were only intermittently in the Duke's possession. It speaks volumes both for his generalship and his powers of administration that his duchy proved as stable as it did.

In a well-known passage in his writings Leonardo states that he will not make public a method which he has discovered for remaining a long time under water because of the evil nature of man who would use it for assassinations under the sea. The passage occurs in the Leicester Manuscript upon which Leonardo was engaged during the years immediately following his return to Florence from the service with Cæsar Borgia. He knew when he wrote it of the evil nature of man. There were instances enough in Urbino, Sinigaglia, Faenza, and the fate of its young lord Astorre Manfredi. He knew also what war was – the 'pazzia bestialissima,' as he terms it. He knew it then as he never knew it when he wrote the letter to Ludovic Sforza. And knowing this he was resolved to forge no new weapon for the assassin's hand. It is ours to record the fact, not to explain it, and yet the existence of this episode in Leonardo's life is somewhat

hard to reconcile with the rounded whole. It seems incongruous to all his realities. He lived, as his manuscripts show, primarily for the things of the mind, and in such ethical system as that in which his thoughts find their natural bourn the relations between man and man are not regulated primarily or at all by self-interest. The mere idea of permitting the existence of unnecessary suffering, still more that of taking life, was abhorrent to him. Vasari tells, as an instance of his love of animals, how when in Florence he passed places where birds were sold he would frequently take them from their cages with his own hand, and having paid the sellers the price that was asked would let them fly away in the air, thus giving them back their liberty.

That this horror of inflicting pain was such as to lead him to be a vegetarian is to be inferred from a reference which occurs in a letter sent by Andrea Corsali to Giuliano de' Medici, in which, after telling him of an Indian race called Gujerats who neither eat anything that contains blood nor permit any injury to any living creature, he adds 'like our Leonardo da Vinci.'

More significant as revealing his inmost thoughts is the passage on the reverse of a sheet of drawings in the Royal Library at Windsor in which with words of deep sincerity he has expressed his sense of the supreme sanctity of human life. The sheet contains various anatomical studies of the figure of a man having the deltoid muscle of the shoulder carefully delineated. Referring to this, and addressing an imaginary questioner, Leonardo says:

'And thou, man, who by these my labours dost look upon the marvellous works of nature, if thou judgest it to be an atrocious act to destroy the same, reflect that it is an infinitely atrocious act to take away the life of man. For thou shouldst be mindful that though what is thus compounded seem to thee of marvellous subtlety, it is as nothing compared with the soul that dwells within this structure; and in truth,

whatever this may be, it is a divine thing which suffers it thus to dwell within its handiwork at its good pleasure, and wills not that thy rage or malice should destroy such a life, since in truth he who values it not does not deserve it.'

So Cæsar Borgia, after shedding men's blood like water to gain a principality, perished in an obscure skirmish, slain for his glittering armour.

TUSCANY

When Leonardo returned to Florence the long war against Pisa was engaging all the energies of the republic. Since the year 1494, when Pisa had declared her independence, the army of Florence had been employed in attempting either to take the city by storm or to reduce it by famine. The nature of Leonardo's work under Cæsar Borgia may have suggested to the Signoria some similar use of his services. The first record of his activity after his return is contained in a despatch concerning a proposal to divert the course of the Arno, which was written by Francesco Guiducci from the Florentine camp against Pisa on the twenty-fourth of July 1503. He states that on the previous day 'Alessandro degli Albizzi together with Leonardo da Vinci and certain others have been there and have studied the plan with the commander-in-chief, and after much discussion and considerable difference of opinion have come to the conclusion that the work would be very suitable, whether it actually succeeded in turning the course of the Arno or only went so far as the construction of a canal which would at any rate prevent the hills from being menaced by the enemy.' Guicciardini, in his *Storia Fiorentina*, says that although Florentine galleys were holding the sea, ships laden with food slipped through the blockade from time to time, and that consequently a plan was submitted to the Gonfalonier for turning the bed of the Arno below Pisa so that the river should no longer pass through the city but pour itself into the marsh of Stagno, near Leghorn, and Pisa in consequence being left dry could not be re-victualled from the sea and might more easily be reduced. The proposal was discussed by the Ten with the leading citizens, and was at first regarded as fantastic, but Piero Soderini, the Gonfalonier, was a warm advocate, and it was his influence that led to its being attempted, with as result, says Guicciardini, the waste of many thousands of ducats. It follows apparently from Guiducci's despatch that the plan was not

originally drawn up by the commission of which Leonardo was a member, but that they were asked to study it and give an opinion as to its practicality. There is nothing in the despatch to indicate who was its author. The matter seems to have been debated for more than a year, for Villari refers to a letter of Machiavelli in the Florence Archives of the twentieth of August 1504, authorizing its commencement, and this was followed during the next month by many others which are concerned with details.

A dam was to be built across the river to stop its course, and two trenches seven braccia deep, and one twenty, the other thirty braccia wide, were to be dug to lead it to the marsh and thence to the sea. The original estimate of labour requirements was thirty or forty thousand days' work, and that therefore two thousand men might accomplish it in fifteen days. Critics of the scheme declared it to be impracticable because the gradient in the direction of the marsh was slighter than along the existing course of the river, and this was shown to be the case by the fact that when a flood occurred after the completion of the first trench and the water was turned into it, it all ran back into the Arno as soon as the flood subsided.

With the rainy season the labourers deserted. The cost had proved far in excess of the amount estimated, and within two months of its inception the enterprise was abandoned and the trenches were filled up by the Pisans.

In a passage in the Leicester manuscript (fol. 13a), which is of approximately the same date as the scheme, Leonardo has defined the conditions necessary for diverting the course of a river. They differ materially from those followed in the enterprise against Pisa. He states 'that the river which is to be turned from one place to another ought to be coaxed and not treated roughly or with violence, and in order to do this it is necessary to make a sort of floodgate in the river and then lower down another in front of it, and in like manner to

construct a third, fourth, and fifth, so that the river may empty itself into the channel given to it.'

Such other passages in Leonardo's writings as refer to alterations in the channel of the Arno are connected with a plan for the construction of a navigable canal, a project which was realized two hundred years later by a disciple of Galileo, but of which according to Vasari Leonardo was the first pioneer. 'He too it was,' he states, 'who though a mere youth (ancora che giovanetto) put forward the project of reducing the Arno from Pisa to Florence to a navigable canal.' Ravaisson-Mollien, building extensively on a somewhat slender premise, connects this statement with Lorenzo de' Medici's visit to Pisa in the autumn of the year 1472, and suggests that Leonardo, who was then a youth of twenty, was employed by him as engineer for the work. If, however, Leonardo had held such a post it is reasonable to assume that there would have been some further evidence of the fact, and Vasari only refers to Leonardo as discussing the project. In saying that he was the first pioneer Vasari is obviously in error, for, as Seidlitz has shown, the plan of a canal from Florence to the sea was the subject of a resolution by the Signoria in 1347, and again in 1458, and the architect Luca Fancelli, writing from Milan in 1487, reminded Lorenzo de' Medici that he had discussed the project with his father Piero, who had died in 1469. As originally conceived the work was to follow the line of the Arno to Signa and the cutting of the Gonfalina, but the difficulty presented by this narrow defile through which the Arno flows led Leonardo to make a wide detour to the north in the line of his proposed canal, the route of which, as shown by a sketch map in the Codice Atlantico (folio 46r.b), passes from Florence through Prato and Pistoia to Serravalle, and there turning south enters a small lake called Lago di Sesto, and from there proceeds through comparatively level country, leaving Lucca some distance on the west, to Vicopisano, where apparently the intention either was that the canal should cross over the

Arno and take a more southerly route, or unite with the river for the remainder of its course.

Folio 46v.a of the Codice Atlantico, which Calvi considers to be of the same date as folio 46r.b, and one of the drawings of which bears the inscription 'canal – per a Firenze,' and also folios 211v.a and 361r.b all contain drawings and descriptions of canals with lock chambers and walls of support, intended apparently to show how canals may be made to pass over rivers. Baratta interprets these to refer to the crossing of the Bisenzio and the Ombrone on the route between Florence and Pistoia. All the details of the project as given by Leonardo are essentially and unusually practical, although perhaps on the financial side somewhat too sanguine. In what is perhaps the earliest reference, C.A. fol. 398, he says that the Guild of Wool is to construct the canal and take the revenue accruing from it; that it is to pass by Prato Pistoia Serravalle and go into the lake; to be without locks, by which it will be more lasting and will produce more revenue in the places through which it passes.

The rapidity of the changes in the volume of the Arno – a spectacle apparent to all travellers – led him to consider how the supply for the canal might be made more stable, and to this end he proposed the construction of a reservoir in the upper waters of the Arno.

On folio 46r.b, where is the sketch map, he says under the heading 'Canal of Florence': 'Let sluices be made in the Val di Chiana at Arezzo so that when there is a shortage of water in summer in the Arno the canal may not remain dry; and make this canal twenty braccia wide at the bottom and thirty at the top, and two braccia deep, or four, so that two of these may go to serve the mills and the meadows which will benefit the country; so that Prato, Pistoia and Pisa, together with Florence, will gain two hundred thousand ducats a year and will supply labour and money for this useful work, and the Lucchesi the same because the lake of Sesto will be made navigable. I shall make it pass by way

of Prato and Pistoia and cut through Serravalle and make an opening into the lake; for there will be no need of locks or supports, which are not lasting and so will always be giving trouble in working at them and maintaining them.' To this there follows a very detailed computation of the cost of construction of the canal, estimated per square braccia. Folio 46v.a of the Codice Atlantico contains sketches and studies of canals passing over rivers, in which Leonardo defines the requisite number of arches of the bridge as three to allow for floods if the river is normally of the width of one, and the necessity for the same reason of making the arches of the bridge as high as possible. A note estimates the expense of the excavation of the canal as not less than four denari per braccio on the assumption that the daily wage of each worker is four soldi.

He recommends that the period for the construction of the canal should be between the middle of March and the middle of June, because the employment of the peasants is slack and therefore labour can be got more cheaply, and also the days are long then and the heat is not excessive. Folio 46v.b of the Codice Atlantico contains drawings of the supports showing the method of construction and mechanism; one of these is as a lever resting on a fulcrum so made that one end dips down when a ship touches it and the other rises, and so automatically closes the lock and causes the water in it to rise and with it the ship; another represents water pouring through an open sluice into a lock, and a note says that it is important that the ship should be made fast when in the lock to prevent it from being carried forward on the swirl of the water and sunk. These drawings are on the reverse of the sheet on which, in describing the course of the canal, he said that it should be without locks; the fact shows that he was considering at the same time various possibilities and different methods.

The route of the projected canal through Prato, Pistoia and Serravalle avoided the difficulty of the Gonfolina defile,

but the height of Serravalle, which forms a northern spur of Monte Albano, presented engineering difficulties enough. At first apparently Leonardo proposed to make a huge cutting, and it was in the expectation of being able to do this successfully that he said that the canal should be without locks. As an alternative method, as is shown by a drawing in the Codice Atlantico, folio 108v.a, he essayed the problem of surmounting the height by the help of science. In this he has represented a section of a canal formed by a series of lock chambers arranged zigzag fashion and so ascending a hill. The dimensions of these are ten braccia deep and eight wide. A river is seen winding in a long spiral and the canal starts from it at the centre of the bottom of the sketch and crosses above it half-way up in its ascent.

Lines *ab* and *ac* are drawn from the summit *a* to the river in the left foreground *b*, and to *c* where the river is visible to the left beyond the bridge formed by the canal. The letter *d* denotes the curve of the river on the right. On the left above the sketch Leonardo has written, 'every large river may be conducted up the highest mountain on the principle of the siphon.' In another note, which may perhaps need the accompanying sketch for its full illumination, he says, 'if the river *cdb* sends an offshoot in the point *a* and it falls back again in the point *b* there will be so much greater weight in the line *ab* than the line *ac* that it will not be able to steal so much as will serve to conduct ships up mountains.' Leonardo's theory as explained by Seidlitz is that a powerful stream according to the principle of the siphon could be led up the highest mountain, since an offshoot of it can be driven up the mountain by a system of sluices arranged zigzag fashion, by which the rapid fall of the water from the height generates so much force that by means of it the suction apparatus for raising the water from one lock chamber to another can be set in motion.

The lines on which he approached the problem of raising the level of the water in the canal to the required height

are such as might be looked for from a student of Archimedes, to whose works the references in his manuscripts are more frequent than to those of any other of his predecessors in the sphere of practical mechanics. They are both novel and daring; and if the opportunity had ever been given to Leonardo to attempt their realization, if men and money had been his to command, it is not impossible that his genius would have found sufficient of a way through technical difficulties to cause this enterprise to rank among the greatest of his engineering achievements. All the opportunity, however, which fate allowed concerned only such portion of the whole scheme as should serve the exigencies of the military situation, which called for a new weapon in the secular war against Pisa.

There would seem to be no valid reason for doubting the accuracy of Vasari's statement that Leonardo investigated the problem of the canalization of the Arno during his early years at Florence. In the draft of the letter to Ludovic Sforza he expresses himself as ready to give him satisfaction 'in bringing water from one place to another,' and he was not likely to make such an offer unless he had already studied hydraulics.

At Milan he was employed in irrigation and canalization projects, and then the meeting with the Florentine architect Luca Fancelli, who went to Milan as one of a committee to consult about the tiburio of the cathedral and who was a firm believer in the practicability of the scheme, turned his thoughts to the subject anew. The pages in the Codice Atlantico which treat of 'the canal of Florence' are assigned by Calvi on chirographical grounds to about the year 1490, which harmonizes entirely with the supposition that Leonardo had been led to consider the project afresh by the stimulus of intercourse with Luca Fancelli, who was in Milan in 1487. Perhaps it was at a later period, when back in Tuscany, that he changed his mind through the evidence there afforded him in course of travel as to the need of

sluices and lock chambers in view of the hilly nature of the country. The summons to assist in the project of Soderini found the ground well prepared. Leonardo's studies and investigations served equally for the making of a canal whether its primary purpose was to bear commerce or to drain off the stream from Pisa. Whereas, however, in the first case the quantity of water which should pass through the canal was to be regulated by the construction of sluices as far back in the upper waters of the Arno as the Val di Chiana above Arezzo, in the second the attempt to turn the course of the Arno through the marsh of Stagno to Leghorn was to begin only in the lower waters of the river near to Vicopisano, where it had already gathered into itself all the strength of its tributaries. As a consequence it was found that whereas the Arno at its delta had tended to silt up, as the great dam was built – slowly as was inevitable – the gradual narrowing of the bed increased the force of the current and so deepened the bed. But for this error it is Piero Soderini rather than Leonardo who should be held to judgment.

FLORENCE 1503–1506

On the eighteenth of October 1503 Leonardo's name was inscribed afresh on the roll of Florentine painters. The date cannot be considered as marking the inception of the period during which he was again principally occupied with artistic work. It may have been as a preliminary to his commission from the Signoria to paint an historical composition on one of the walls of the Sala del Consiglio, as it was followed eight days afterwards by the delivery to Leonardo of the keys of the Sala del Papa in order that he might work there upon the cartoon. The fact of Leonardo having been awarded this commission – the only one ever given him in Florence by a public authority – was in part due no doubt to the fact of his having been a member of the commission to consider the question of diverting the Arno, which had brought him into close relationship with the Gonfalonier Piero Soderini, the author of the scheme.

Already before this he had commenced the Mona Lisa. The genesis of this supreme example of Leonardo's art is thus referred to by Vasari: 'Leonardo undertook to paint for Francesco del Giocondo the portrait of Mona Lisa his wife, and after he had lingered over it for four years left it unfinished.' Leonardo did not return to Florence from the Romagna until March 1503, and was in Milan from May 1506, so that either he began the picture before his service with Cæsar Borgia and then resumed it, or, as seems more probable, he commenced it very soon after his return: in which case Vasari's estimate of time cannot be interpreted quite literally, as the maximum of time during which he can have worked on the picture is little more than three years. Records show that the lady was a member of the Neapolitan family of Gherardini and was the third wife of Francesco del Giocondo, and as she was married in 1495 she was presumably between her twenty-sixth and thirtieth year when Leonardo commenced to paint her portrait. The contrast of type with the Madonnas which it presents is an instance of his

essential realism. These are Northern in all essential characteristics; it is the placid seductive grace, the languor and reposeful confidence of Parthenope that lives in the Mona Lisa. If any notes of faces registered when mood of artist supervened in his wanderings have gone as ore to the crucible where this took shape, it may be that the lineaments have also some suggestion of Romagnol beauty. The work executed during the second period of residence in Florence shows his art in full maturity. The drawings which serve as the main index of it – the study at Windsor for the Neptune for Antonio Segni, the St. Anne cartoon, the various studies for groups and single combatants in the Anghiari cartoon – unite perfection of delicacy and softness of modelling to what seems to be an almost absolute rightness of line. This is perhaps most readily apparent when there is swiftness of action as in the steeds of Neptune tossing the spray with their hoofs, or the frenzy of the combatants in the 'Anghiari' studies; in the Mona Lisa the power is seen in quiescence. Just as in the greatest poetry there is often the touch of prose, the something inevitable which makes the result seem effortless by contrast with art less perfect, the selective faculty being apparently absent and art veiling her processes; in Webster as in Shakespeare; in the

'Cover her face; mine eyes dazzle; she died young'

of the Duchess of Malfi, or Vittoria Corombona's dying words:

'My soul like to a ship in a black storm
Is driven, I know not whither,'

as well as in the babblings of the demented Lear:

'Do not laugh at me;
For, as I am a man, I think this lady
To be my child Cordelia.'

Even so does the Mona Lisa live in the memory as a

supreme utterance, effortless in its inevitability even as these, all theories, all sciences, held in complete and willing subservience to the artist's joy in creation.

Generations of critics have analysed their emotions in its presence with results of very varying interest. One of these was a man of genius, and his sentences have a trick of living in the memory. But despite all the critics, still, as Millais expressed it, 'paint is paint and words are words, and you cannot express the one in terms of the other.' Vasari was the first of the whole company, and it is he who comes nearest to a definition of what exactly it was that Leonardo had done.

Evidence of his reabsorption in the current of the artistic life of Florence is afforded by the fact that in a document of the twenty-fifth of January 1504 his name appears in company with those of a large number of the most eminent artists, amongst them being Andrea della Robbia, Piero di Cosimo, Botticelli, Giuliano and Antonio da Sangallo, Perugino and Lorenzo di Credi, as members of a commission to advise as to the most suitable site for Michelangelo's statue of David. Leonardo and a majority of the commission agreed with the recommendation of Giuliano da Sangallo that the statue should be placed in the Loggia dei Lanzi in order that the marble might be protected from injury caused by the severity of the weather, but the verdict of the commission was set aside by the Signoria in favour of that of Michelangelo himself who desired that the statue should be placed at the entrance to the Palazzo Vecchio.

A difference of opinion more or less acute occurs in each of the records of the meeting of Leonardo and Michelangelo. The latter was the junior by twenty-three years, and the quality of his mordant humour is shown in the account by the Anonimo Gaddiano of how on one occasion, after Leonardo had suggested that he should be asked to explain a passage of Dante, thinking that he was being jeered at he replied angrily, 'Explain it yourself, you who made a draw-

ing of a horse in order to cast it in bronze and could not cast it, and out of shame had to abandon it.' 'And having said this,' the Anonimo adds, 'he turned on his heel and went away, leaving Leonardo flushing red at his words.' The same authority tells how on another occasion Michelangelo, wishing to vex Leonardo, said to him, 'And so they believed in you did those capons the Milanese!' Perhaps it was after a surfeit of taunts such as these from an artist twenty-three years his junior that Leonardo wrote in the Codice Atlantico (fol. 117v.b): 'A simile of patience. Patience serves as a protection against wrongs as clothes do against cold. For if you put on more clothes as the cold increases it will have no power to hurt you. So in like manner you must grow in patience when you meet with great wrongs and they will then be powerless to vex your mind.'

Something of this magnanimity had indeed been shown in the fact of his being one of the commission to consider a site for the *David*, for according to Vasari Piero Soderini the Gonfalonier had talked of giving the great block of marble which had lain for some thirty-five years in the Opera del Duomo to Leonardo in order that he might make a statue, and then as the assiduous efforts of Andrea Sansovino bid fair to obtain the coveted commission Michelangelo's friends had advised his return from Rome in order to secure it.

When the Florentine Republic, revelling in a new-found sense of security consequent upon the disappearance of the menace of Cæsar Borgia, decided to have the walls of the newly constructed hall of the Great Council decorated with scenes from Florentine history, it was upon Leonardo that their choice first fell. Ten months later Michelangelo, after his *David* had been set up in position, was given the work of painting a subject on the opposite wall. Human nature being what it is, it was natural that in a contest of endeavour between the two artists such as this each should strive to give of his best. And in the sequel so long as the cartoons which

Leonardo and Michelangelo executed for these commissions remained complete they formed, according to the testimony of Benvenuto Cellini, 'the school of the world.'

The choice of subjects was made presumably by the Signoria, who assigned to Leonardo the battle of Anghiari, a relatively unimportant skirmish which took place in 1440 in which the Milanese under Niccolo Piccinino were defeated by the Florentines; and to Michelangelo the battle of Cascina, the actual scene represented being just before the battle when the Florentines were surprised by the Pisans while bathing.

Leonardo prepared his cartoon in the Sala del Papa at S. Maria Novella, and Michelangelo made his in the Hospital at Sant' Onofrio. The latter completed his cartoon and then left Florence, while Leonardo was still at work on the commission. A description of the events of the battle of Anghiari which occurs among Leonardo's manuscripts (Codice Atlantico 75r.b.) was probably, as Richter suggests, drawn up by some historian for Leonardo's guidance at the request of the Signoria. According to Solmi the writer of this detailed memorandum was Niccolo Machiavelli, whom Leonardo probably met in his official capacity on the occasion of his visit to Cæsar Borgia at Urbino, and also undoubtedly in connection with the scheme for diverting the Arno. Machiavelli also probably, according to Solmi, selected the subject of the composition and wrote the description for the artist's use, and in the fervour of conviction he even discerns a similarity between this and the description of the battle in Machiavelli's Florentine History. The argument as to Machiavelli's authorship on paleographical grounds is dissented from by Calvi and may therefore be discounted. Although there are some resemblances between the two descriptions, as is natural in that they describe the same sequence of events, the difference is far more striking. In the description compiled for Leonardo the battle is regarded in the light of an homeric combat, whereas in Machiavelli's History,

written some twenty years later, it figures in its true proportions as somewhat of the nature of a dress parade. The two concluding paragraphs serve to illustrate the essential difference. In the account in the Codice Atlantico, after describing how the vanquished took to flight towards Borgo San Sepolcro, it adds: 'And then began a great slaughter of men; none escaped but the foremost of those who had fled or who hid themselves. The battle continued until sunset, when the Patriarch gave his mind to recalling his men and burying the dead, and afterwards a trophy was erected.' Machiavelli in his Florentine History says, 'in so great a defeat and in a battle which continued four hours, only one man died, and he, not from wounds inflicted by hostile weapons, or any honourable means, but, having fallen from his horse, was trampled to death.'

It is almost inconceivable that the judicious historian who wrote the second of these two passages could also have written the first as a description of the same historic event even though there are twenty years between the dates of the two passages. It would seem indeed, judging from the style of the narrative, that the writer of the description among Leonardo's papers was a more imitative student of the saga-like method of Giovanni Villani in his Florentine Chronicles than ever Machiavelli was in his History. Whether intended or not to serve as a literal direction, he detailed a sequence of events. In the first, Niccolo Piccinino addresses his troops, then mounts his horse in full armour and is followed by forty squadrons of cavalry and two thousand foot soldiers. They are discerned afar by the Patriarch, who has ascended a hill at dawn to reconnoitre, and he returns to address his troops, and after he has prayed, Saint Peter appears to him in a cloud and counsels him to advance his cavalry, and so they hold the bridge and there await the Milanese onset. Then the bridge was taken and retaken, and so for a long time they fought with varying fortune. All this wealth of incident, Saint Peter, cloud and all, the earlier Tuscan art would have revelled in;

but it was not until its conclusion that Leonardo found the narrative malleable to his thought.

The bridge, the possession of which was the emblem of victory through all the vicissitudes of the combat, appears in a drawing in the Venice Academy.

By the side of it in a group of horsemen fighting for the possession of a standard Leonardo has represented the very spirit of combat.

It lives in the contest of man with man and steed with steed, shown with utmost freedom and swift intuitive insight. There are other studies of this group at Venice and Windsor, and heads of three of the combatants at Buda-Pest, all of which show the absolute and inevitable rightness of his draughtsmanship at this period; but the full extent of the vigour and dramatic intensity of the action which unites the characters is nowhere more strikingly apparent than in a sketch of the group in coloured chalk by Rubens now in the Louvre, although it is evident from the date of the destruction of the original that this can only be a copy from a copy. A sketch in the University Galleries at Oxford made by Raphael of the part of the cartoon in which this group occurs, together with a horse above it, enables us to locate a group of horsemen advancing with lifted lances and streaming pennons copied by Cesare da Sesto in a sketch at Windsor, as having figured on the right of the group fighting for the standard, and so proves that the latter formed, not as has been imagined the whole, but a part, certainly the most important part, of the composition of Leonardo's cartoon.

In a section of that treatise on painting of which the greater part was written during his life at Milan Leonardo has attempted to define in words 'the way to represent a battle.' When he wrote it he had had the opportunity of observing the battle pieces of his predecessors Paolo Uccello and Piero de' Franceschi, each faithful after his fashion to the prevailing tendencies of mediæval warfare, which as conducted by the condottieri was something of a pageant and

something of a tournament, to the representation of which they imparted new dignity and new impressiveness by the sum of their researches in perspective and chiaroscuro, yet left it almost in such static immobility as they had found it, the force that should generate action still girt in the trappings of pageantry.

Leonardo, who in a pregnant sentence in his manuscripts characterized war as an utterly bestial frenzy, 'pazzia bestialissima,' laid his foundations in stark realism. 'Show first,' he says, 'the smoke of the artillery mingled in the air with the dust stirred up by the movement of the horses and of the combatants.' Then he considers the visibility of the combatants as seen through the haze thus created, the air also being full of arrows and trains of smoke following the course of the balls shot from the guns. In his notes concerning them, he emphasized the passion of combat, the agony of death, the awfulness of the mutilation and destruction of what is fair in life and nature. His effects are cumulative, built up of many details with the fidelity of Tolstoy or Verestchagin. The faces of the combatants delineated relentlessly; the concentrated fury of the conquerors intent only to slay; the conquered pallid, with brows knit, 'the skin above the brows filled with lines of pain,' nostrils dilated, lips arched, teeth parted, crying out in lamentation; the dead, some half buried in dust, others with the dust mingled with the oozing blood and changing into crimson mud; others in the death agony, eyes rolling, fists clenched and limbs distorted; one disarmed and struck down by the enemy turning on him with teeth and nails. A horse dragging the dead body of his master; another riderless charging among the enemy and doing great mischief with his heels; a heap of men fallen on top of a dead horse. Some of the victors leaving the combat, wiping away the mud from their eyes. Squadrons of reserves standing shading their eyes with their hands as they peer into the heavy mist awaiting the commands of their leader, who is seen hurrying with staff raised to show them where to ad-

vance. He would show also a river with horses galloping into it, a heaving mass of foam and broken water; and there should be no level spot of ground that is not trampled over with blood. Such was war as Leonardo envisaged it. 'Pazzia bestialissima.' There is, however, no real incongruity in the fact of his having given of his best thought to perfect and devise engines of destruction, for, as he says, man's chief gift of freedom can only be preserved against the designs of tyrants by the use of such means.

What he had already set down with his pen the Florentine Signoria gave him the opportunity to create with his brush, and he laboured to accomplish it with all the ardour of his nature and with a degree of concentration greater than that shown in any other of his artistic works.

The sketch at Venice of the bridge with the group of horsemen fighting desperately beside it serves to link his composition with the narrative of the battle which is found in the Codice Atlantico, but the link is closer that unites it to the passage in the Treatise on Painting, for this is of the spirit. The real Anghiari was, as Machiavelli states, a bloodless skirmish; but with him it is a notable piece of pageantry, and it lives as something more in the narrative which served Leonardo for base, for there the shadows are deeper.

For Leonardo the history was as nothing. Florentine and Milanese alike, the horsemen are mere actors struggling blindly, impelled by the spirit of combat which, still unsatisfied with their utmost frenzy, animates even the horses so that they gnash and rend each other with their teeth. Only when these sketches, which are all that remain of Leonardo's composition, are studied in conjunction with the related passages in the description of 'how to represent a battle' in the Treatise on Painting does the full measure of what he accomplished become apparent. Had fortune been propitious it would have served the Florentines as the chief memorial of the ripest stage of his art.

For a time all went well. After the conferring of the keys

of the Sala del Papa and the adjoining rooms at Santa Maria Novella on the twenty-fourth of October 1503, for the purpose of preparing the cartoon, the continuous nature of Leonardo's work at the subject is attested by documentary record. Payments were made for materials in January and February 1504, and these were followed on the fourth of May by the definite contract with the Signoria. This stated that Leonardo had already been paid thirty-five florins for work done, fixed his salary at fifteen florins a month and stipulated for the completion of the cartoon by the end of February 1505, under penalty that in case of non-completion Leonardo should return the money paid and make over the cartoon to the Signoria, and also provided that the picture should be arranged for on the completion of the cartoon. There is a somewhat austere touch about these provisions of the Florentine Signoria. Leonardo had never experienced the like under Ludovic Sforza. The only possible justification for them is that the Signoria had in their minds the history of the Sforza statue and wished by every means in their power to spur Leonardo to rapidity of execution. And in this they were successful. Isabella d'Este chose this time to renew her request to Leonardo for a picture for her studio. On the fourteenth of May she wrote to Tovaglia telling him of her desire and asking him to intercede with Leonardo, 'if he says that he has not time because of the work he has undertaken for the Signoria, let him when tired with the historical work take to it as a relaxation.' Five months later Isabella approached Leonardo again, but this time she wrote to him direct, her desire being, as Tovaglia has already told him but as perhaps he has forgotten, for a small picture of Christ as a child of twelve; if when tired with the Florentine history he will do this for her as a recreation she will prize it dearly and it will be useful to him. But persuasive though it seem, the siren's song was sung in vain, and Leonardo did not tire of 'the Florentine history.' Payments for supplies and materials in August, October and December 1504 and in March

1505 attest his steady progress with the commission. The comparative frequency of these notices furnishes a sufficient reason why the theory of Solmi that the elaborate topographical plan of part of Tuscany with Borgo San Sepolcro and the country around it executed by Leonardo was made while travelling to familiarize himself with the scene of the battle must be considered untenable. There is nothing in any of Leonardo's sketches for the composition which lends weight to the supposition that he would have thought such knowledge at all necessary for the purpose which he had in view. If the topographical plan of Tuscany was made for use in connection with any project of Leonardo's it would seem most reasonable to connect it with his studies for the canalization of the Arno, the sluices for which were to begin in the Val di Chiana in the upper waters of the river.

The payments continued when the date fixed by the Signoria for the completion of the cartoon was past and when Leonardo had completed this part of the work. At the end of February 1505 a stage was erected in the Hall of the Great Council in order that he might begin the painting. Payments for materials, gesso, linseed oil and colours continued down to the thirtieth of August 1505, so that for six months Leonardo must have on occasion worked upon the painting. After August the payments cease and the work was interrupted. The primary reason was a chemical one. The plaster or intonaco laid upon the wall to serve as a surface for the painting was badly compounded. The most circumstantial account of this is that given by the Anonimo Gaddiano: 'he took the receipt for the plaster on which he coloured from Pliny, but did not properly understand it: and the first time he tried it on a painting in the Sala del Papa, in which place he was working, after he had placed it on the wall he lighted a great fire by which on account of the great heat of the said charcoal he evaporated and dried the said material; and afterwards he wished to put it into execution in the Hall of the Great Council, where in the lower part the fire reached it and

dried it, but above on account of the great distance the heat did not reach it and so it ran.' This agrees in all essentials with the testimony of Paolo Giovio and Vasari, the latter adding the information that Leonardo's use of a new recipe was due to his desire to paint the picture in oils on the wall, and also that the fact that he saw that the work was becoming spoilt, was the reason why he soon abandoned it. In this last statement Vasari is somewhat unconvincing. The error as to the plaster, which apparently was successful in the Sala del Papa, but not when tried over a larger surface in the Hall of the Great Council, caused the work to be interrupted, and while the plaster was being further tested by time Leonardo was busy with other studies. It was between the middle of March and the middle of April of the year 1505 that he wrote the small volume *On the Flight of Birds*. In July of the same year he began the first of the little notebooks now in the South Kensington Museum in which he treats of a variety of scientific matters.

A payment to the workmen on the thirtieth of October 1505 for the construction of staging in the Great Hall shows that the question of continuing the work was then under consideration. The cartoon was completed, and in the hall itself the portion of the composition known as the Battle of the Standard was executed, as we know from Albertini's Memoriale, and stood as a witness of his power. As regards the rest there was delay, but the difficulties were not such as to be incapable of solution. The composition of the intonaco might be amended.

Leonardo's definite intention to continue the work and bring it to completion is clearly to be inferred from the protracted correspondence which afterwards arose concerning him between the Signoria and the French Governor of Milan, Charles d'Amboise, Lord of Chaumont. It explains the extreme reluctance of the Florentine Signoria to accede to the requests made in the name of the French King. The first request for Leonardo's presence in Milan was made by Chau-

mont in May 1506, and on the thirtieth of May he obtained permission from the Signoria to go to Milan for three months. On the eighteenth of August Chaumont wrote to the Signoria asking that Leonardo's leave of absence should be extended, at all events until the end of September, as he had need of him in order to finish certain works which he had set him to undertake. In a letter to the Signoria of a day later the vice-chancellor Caroli urged them to comply with Chaumont's request. This was acceded to, but when at the end of September Chaumont asked for a further extension Soderini's patience gave out and he begged that they may be excused from coming to any agreement as to a day for Leonardo's return as he has not conducted himself as he ought towards the Republic, having received a large sum of money and done only a little of the great work with which he was entrusted, adding, moreover, that they desire that there may be no more of such requests because Leonardo's work has to satisfy public opinion and they cannot free him from his obligations without incurring blame. If it were not that Soderini held his office for life we might imagine from the concluding words of this despatch that it was written on the eve of an election. The treatment which Leonardo experienced was in marked contrast to that of Michelangelo, who was given an honorarium of three thousand ducats when he commenced 'the Bathers' and never carried the work beyond the stage of the cartoon.

The letter which Chaumont wrote to the Signoria some two months after the receipt of that by Soderini, Leonardo being then apparently on the point of returning, forms perhaps the best commentary upon it. With grave irony he informs them that their fellow-citizen is a very distinguished painter and that his works, especially those in Milan, win him the affection of all who see them and that he deserves to be held equally in repute in other branches of knowledge. That in the manner in which he has responded to demands made upon his powers for architectural designs and other

matters he has not only satisfied the writer but has won his admiration. If it be fitting to commend a man of such distinction to his fellow-citizens, he does so as strongly as he can, assuring them that in conferring any benefits or honours, however well-merited, upon Leonardo they will also be giving the writer keen pleasure and putting him under a deep sense of obligation. Having formed such sentiments it is perhaps not altogether surprising that Chaumont decided not to part with Leonardo's services, but to let the matter await the coming of the King of France.

The latter on the twelfth of January interviewed the Florentine envoy Pandolfini at Blois and bade him inform the Signoria of his wish to take Leonardo into his service, the cause of this being, according to Pandolfini, a small picture by Leonardo which had but recently been brought there, and which may have been a commission given him by Chaumont. Two days later Louis XII himself wrote urgently to the same effect to the Signoria, begging them to direct Leonardo not to leave Milan until he should arrive there.

The friendship of the Most Christian King was too powerful a factor in Italian politics for there to be any delay in acquiescence. Eight days after his letter the Signoria wrote to Leonardo at Milan to express their pleasure that he should remain there to serve His Majesty, and at the same time they wrote to Pandolfini bidding him inform the King that they were most happy to meet his wishes and were willing that not only Leonardo but any other man whatsoever should serve him according to his desires and needs.

In these despatches we see Leonardo as the sport of circumstances, moved at the will of others, a mere pawn upon the board of state policy.

As he wrote of Ludovic Sforza so of himself it might be written that he 'has seen none of his works completed.' In no case was the loss to posterity greater than in that of the Anghiari composition. Disappointment on the part of the Signoria that the turn of events prevented any possibility of

its resumption was natural, but the reproaches levelled at Leonardo ignored altogether the salient facts of the case. The expression of resentment at the fact of Leonardo's acquiescence in the desire of the French King is strangely inconsistent with their own expression of acquiescence, couched as it is in terms which may fairly be described as obsequious, and with their letter of instructions to Leonardo, written on the twenty-second of January 1507, bidding him serve the French King in all his needs and desires. On the wise principle of preserving what they had, they gave an order on the thirteenth of April 1513 to a carpenter 'to put up a balustrade in order to protect the figures painted by Leonardo in the great hall.' The guarded fragment remained for half a century. Antonio Francesco Doni mentioned it in 1549 in a letter to a friend describing the noteworthy sights of Florence. Eight years later Vasari began to reconstruct the hall preparatory to painting frescoes there. In one of the battle-pieces Seidlitz discerns the influence of Leonardo's work which was destroyed in the course of the renovation. There is no mention of this in the second edition of Vasari's *Lives* published in 1568. Either it occurred at a somewhat later date, or Vasari may have felt a natural reluctance to chronicle the fact.

MILAN 1506–1513

On the twenty-fourth of May 1507 Lous XII made a ceremonious entry into Milan. Leonardo, by an order of Chaumont of the previous month, had been restored possession of his vineyard outside the Porta Vercellina. He was back in the old surroundings, with the French as patrons in place of the Sforzas. The pageant of welcome which met the King's eye is recorded in picturesque detail by his chronicler Jean d'Autun. It may be conjectured that some share of it fell upon Leonardo. At this time presumably he constructed the mechanism to which Vasari refers when he says that when the King of France came to Milan Leonardo was requested to make some novelty, and thereupon constructed a lion which could walk several steps and then opened its breast which was found full of lilies.

Lomazzo, who also refers to this incident, gives the name of the French King as Francis I, who entered Milan in 1515, but it is somewhat doubtful whether at this time Leonardo was in Milan. Sketches presumably intended for the automatically moving lion are to be found on folio 179r of the Codice Atlantico. They are on the same sheet as a drawing of a right hand with forefinger pointing upwards which was used as a study for the *St. John* in the Louvre; the juxtaposition seems to suggest that this picture was one of those on which Leonardo was at work for Chaumont or for Louis XII. The sketches of the lion are slight and scarcely do more than suggest the nature of the mechanism. It was a far cry from the Anghiari commission and all that it had meant in his art to the construction of peripatetic automata such as this.

But behind the band of French administrators was the vast reserve of French power, and this produced a sense of stability in Milan such as the city had never known in the days of Ludovic Sforza, and this must have been welcome to Leonardo, who moreover received from the French governor Chaumont a degree of sympathetic consideration which

he never met with elsewhere. So it came to pass that for six years he remained in the service of the French King, with Milan as his headquarters. Pandolfini, in his letter to the Florentine Signoria of the twelfth of January 1507, reported a conversation he had had with the King, in the course of which Louis XII, in reply to a question as to the nature of the work upon which he proposed to employ Leonardo, had replied, 'upon certain small pictures of Our Lady and others as the mood takes me, and perhaps I shall also set him to paint my portrait.' Such intentions would follow naturally from the fact that, as Pandolfini says, it was the sight of a small picture by Leonardo which had awakened in the King's mind the wish to secure Leonardo's service, but nevertheless the record of Leonardo's life at Milan during the French occupation is somewhat barren as regards artistic work. He was not employed upon any composition of a monumental character, but principally upon cabinet pictures, and of these only one can be identified with any degree of certainty. It was one of the two Madonna pictures mentioned by Leonardo in a letter to Chaumont written from Florence, where he had returned on account of litigation concerning the estate of his uncle. This at the time when he writes is almost at an end and he hopes to be back in Milan by Easter, and to bring with him two pictures, 'Madonnas of various dimensions, which he has begun for the Most Christian King or for whoever else it shall please Chaumont to bestow them.' Leonardo returned to Florence in the autumn of 1507, and the letter was therefore written early in the following year.

There is some suggestion of leisure in the records of this period of his life at Milan and of *bien-être* such as he had never known in Florence. The memory of his works done in the period of the Sforzas lived in the city and made the new rulers his courtiers. His presence offered a promise that the splendour of the old days should return and the magic of his personality made the hope seem a certainty. Chaumont in a

letter to the Florentine Signoria, written in December 1506, referred to having given him the work of executing certain drawings and architectural commissions. Possibly some of the latter were for buildings to be erected in France: there is nothing by which any may be identified. A fragment in his manuscripts which bears the heading 'Canonica di Vaprio 5 July 1507' shows that he was then staying with the Melzi family, and perhaps dates the beginning of his friendship with the young Francesco, son of Girolamo Melzi, then a youth of fourteen, who afterwards became like a son to Leonardo and accompanied him wherever he went. Soon after this private affairs necessitated his presence in Florence. His father, Ser Piero da Vinci, had died in 1504 intestate, and the seven legitimate sons had excluded Leonardo from sharing in the division of his property. In 1507 his uncle Francesco died, leaving a will, and his brothers attempted to set it aside and exclude Leonardo from the share bequeathed to him. He therefore returned to contest the case. His return was heralded by letters from Louis XII and Chaumont, addressed to the Gonfalonier and the Signoria of Florence, urging them to get the case expedited as much as possible in order that Leonardo might be able to return to Milan, where his presence was much desired for the execution of the works entrusted to him, and in the King's letter Leonardo was styled 'nostre chier et bien amé Léonard da Vincy, nostre paintre et ingénieur ordinaire.' Soon after his arrival in Florence he himself wrote to the same effect to the Cardinal Ippolito d'Este to ask him to write to Ser Raffaello Hieronymo, a member of the Signoria before whom the case was being tried, to recommend the writer to him, and to ask not only that he would do him justice but that he would do so with all possible despatch. In spite, however, of all these efforts to expedite the course of justice, it was full six months, and probably longer, before the case was finally settled. In a fragment of a letter written from Florence to the Governor of Milan Leonardo states that he

is almost at the end of his litigation with his brothers and hopes to return by Easter, and to take with him two pictures of the Madonna of different sizes which have been done either for the Most Christian King or for whomsoever else his Lordship pleases. During this enforced sojourn in Florence he had also given much time to scientific work and started to arrange his results, as is shown by the opening sentence of the manuscript now in the British Museum (Arundel 263): 'Begun at Florence in the house of Piero di Braccio Martelli, on the twenty-second day of March 1508. And this is to be a collection without order taken from many papers which I have copied here, hoping afterwards to arrange them in order each in its place, according to the subjects treated of; and I believe that before I come to the end of this I shall have to repeat the same thing several times, for which the reader must not blame me, because the subjects are many and the memory cannot possibly retain them and say, "I will not write this because I wrote it before." For if I wished to avoid falling into this error it would be necessary that in every case when I wished to copy out a passage in order not to repeat myself I should read over all that had gone before, and the more so because of the length of interval between one time of writing and another.'

He was waiting for the decision of a lawsuit, with work to do for his patrons at Milan while he waited. Little more than a year since he had worked on the Anghiari composition. But already how far away! He had access again to the libraries of Florence, and this reinforced the impulse to the study of mechanics as being of all the sciences the one which touched practical issues most nearly. As he wrote in Manuscript E of the Institut, 'mechanics is the paradise of the mathematical sciences because in it we come to the fruits of mathematics.' So it is to the elucidation of problems of mechanics, citing Archimedes as his authority, that the opening pages of the British Museum manuscript are

devoted. Thereafter he redeems lavishly the promise of the introduction that the volume should treat of many matters. Only in the great reassembled manuscript known as the Codice Atlantico is the encyclopædic range of his knowledge and interests as impressively displayed as here. Tossed to and fro upon a turbid sea by the tortuous currents of statecraft, he lived always in a world of the spirit, where art and science meet in a sustained harmony. He was alive to every influence of beauty, while alert to follow every manifestation of natural phenomena in the search for primary laws and causes. Here he was constantly the forerunner. This may be discerned in certain of the passages in the Arundel manuscript in which he defines the elements of landscape painting: the radiance of sunlight and its effect on foliage, and clouds seen with the sun beyond them, studied with the fervour of Turner or Monet; variation in the colour of the verdure of the fields according to the degree of density of the mist in the atmosphere, and the effect of mist on the form and colour of natural objects analysed in a passage which Whistler might have written if it had ever come about that he 'set down with the pen what he did with the hand'; degrees of variation of shadow in trees, effect of wind on foliage defined with something of that fidelity, that innate sympathy with and closeness of perception of the ever-changing conditions of nature which we find in the creations of Harpignies and Anton Mauve. It is to the work of modern masters such as these, men 'who,' as Meier-Graefe says, 'know what art is because they possess nature,' that the thought flies for confirmation when we consider in detail Leonardo's precepts for the painting of landscape. Woodland mystery and remoteness, subtlest suggestions of shadow, radiance of light and colour and form all that was theirs in nature to interpret spring to meet us, inchoate yet tangible, in such a sentence as this of Leonardo's for invocation: 'describe landscapes with the wind and the water and the setting and rising of the sun.'

The laws of linear and aerial perspective, botany, optics, astronomy, physiology, physical geography and architecture are among the other subjects treated of in passages of this manuscript with all a scholar's absorption. The first description of the contents made when the manuscript passed into the possession of the British Museum designates them somewhat naïvely as 'unconnected notes'; but despite all their diversity they seem like the facets of a precious stone, and mirror the depth and profundity of the mind that gave them birth. The passages which treat of architecture seem to be sections intended to form part of a compendious whole. In them he examines in some detail the causes of the fissures in walls, the nature of the arch and the laws which govern it, and the nature of foundations and supports for buildings. Other sections are connected with the treatise on the nature of water which formed the subject of the Leicester manuscript and have to do with the fourth division of the book, concerning rivers, and their origin and uses and various methods by which they may be directed and controlled to serve new uses. In a fragment in Manuscript F of the Institut entitled 'the order of the book' he says, 'place at the beginning what a river can effect,' and here, with a fine sense of relative values, he heads the list with 'a book of driving back armies by the force of a flood made by releasing the waters.' Among the projects which follow is that of 'a book of boats driven against the impetus of rivers,' in which he seems to foretell the existence of steam-propelled vessels, 'a book of the various motions of waters in their rivers,' another 'of the various forms of shoals formed under the sluices of rivers,' and another 'of conducting navigable canals above or beneath the rivers which intersect them,' which show that the project of making the Arno a navigable canal was not an isolated and fantastic experiment, but a natural sequence of his study of how to control and direct the use of water.

In the many matters of which the Arundel manuscript

treats it is the mood of the scientist and mathematician that prevails, and yet so rich is its diversity that were it the only one of his manuscripts which had escaped the mischances of time it would serve in some measure to substantiate the half-legendary claim of the universality of his mental interests. On occasion, scientific though the purpose be, he clothes it in a simile of unforgettable beauty, as when in folio 25r he speaks of the waves 'which intersect like the scales of a fir cone,' reflecting the image of the sun with the greatest splendour: this being the case because 'the images are as many as the ridges of the waves on which the sun shines and the shadows that come between these waves are small and not very dark, and the radiance of so many reflections is united in the image which they transmit to the eye, thus causing the shadows to be imperceptible.'

In various passages intended perhaps to form part of a treatise on the natural history of the earth the mood of the scientist yields to that of the prophet, and the imaginative power with which he presents his conclusions, as in the vision of the end of all terrestrial nature in folio 155 *verso*, reveals him as a master of language, able by his pen as by his brush or chisel to create the image which the brain conceived. There are fables, and also a considerable number of the 'prophecies,' the name he chose for certain short antithetical sentences of a somewhat veiled import in which his moral fervour found its most free and piercing expression in scorn and denunciation of cruelty and hypocrisy, the prophetic form in which the thought is couched being such as to assume that with the dawn of the age of reason all evil, being an offence against man's own nature, would cease utterly.

Other allegorical passages accompanied by drawings seem to have reference to his own experience of the favour of princes, e.g. 'on the shield a large mirror to denote that he who truly desires favour must be mirrored in his virtues.' 'On the opposite side,' he continues, 'will be represented Fortitude in like manner with her column in her hand.

robed in white . . . and Prudence with three eyes.' In place of the fervour and scorn of the 'prophecies' and the veiled import of the allegories we turn to the calm utterance of the stoic: 'behold now the hope and desire to go back to our own country, and to return to our former state, how like it is to the moth with the light! And the man who with perpetual longing ever looks forward with joy to each new spring and each new summer, and to the new months and the new years, deeming that the things he longs for are too slow in coming, does not perceive that he is longing for his own destruction. But this longing is the quintessence and spirit of the elements, which, finding itself imprisoned within the life of the human body, desires continually to return to its source. And I would have you to know that this very same longing is that quintessence inherent in nature, and that man is a type of the world' (folio 156v.).

In this, as in all his manuscripts, there occur names of books and authors, showing how he borrowed them from friends and made use of libraries, the most enigmatic of these being a brief reference in folio 71 *verso* to Roger Bacon, 'Roger Bacon done in print.' A few pages of the manuscript would seem to be of a much earlier period than the rest. Richter ascribes them to Leonardo's youthful period in Florence from the style of the writing.

There are also dated memoranda of an earlier period telling of the death of Ser Piero da Vinci and of things to be taken for a hurried journey, which latter passage, as it contains a reference to 'Valentino,' must presumably have reference to his service under Cæsar Borgia. There are a few notes also which treat of the topography of various places in France, such as the Loire, Amboise, Romorantin, and 'the road to Orleans.'

These are of the time of Leonardo's residence in France. By far the greater part of the British Museum manuscript was written either while at Florence in 1508 or soon afterwards.

The Piero di Braccio Martelli with whom Leonardo stayed when he was in Florence in 1508 was Commissioner of the Signoria and also a student, four books on mathematics being among his papers at his death; common interests may have drawn the two together, and the association furnishes a reason why in the British Museum manuscript mathematical observations are very frequent. The Martelli family were hereditary patrons of art. Vasari tells how they assisted Donatello, and how they possessed works by him in marble and bronze. In like manner, as Vasari also tells, Piero di Braccio Martelli assisted Giovan Francesco Rustici, who lived for a time in the Via de' Martelli, and acquired reliefs and also pictures by him. Rustici was presumably living in Piero's house at the same time as Leonardo, for in the life of the latter by the Anonimo Gaddiano he is said to have stayed for six months in the house of Rustici the sculptor in the Via de' Martelli. The association of Leonardo with Rustici is borne witness to by Vasari, who in his life of Leonardo speaks of him as having assisted Rustici with his counsel when the latter executed three bronze figures representing St. John, a Pharisee and a Levite, which are above the north door of the Baptistery, and in his life of Rustici relates the circumstance with greater detail, stating that 'while Giovan Francesco was modelling the work in clay he would permit no one to be near him but Leonardo; and he, whether in preparing the moulds or securing them with their irons, in short at every stage of the work up to the casting, was constantly at his side; for which reason some are of the opinion, without having any further source of knowledge, that Leonardo worked upon the figures with his own hand, or at any rate helped Giovan Francesco with his counsel and good judgment.'

Milanesi discounts Vasari's statement that Leonardo assisted Rustici in the execution of the statuary on the ground that the commission was given in 1506 and that Leonardo was then in Milan engaged upon work for the

King of France and Chaumont. The commission was not, however, actually given to Rustici until the middle of December 1506, and was to be finished in two years, but although according to Vasari Rustici started upon it immediately and made a small model of the whole, an extension of time was asked for and conceded in March 1509, the clay models were only completed in the following September, and the works were not cast in bronze until 1511. There is therefore no chronological difficulty to be surmounted in accepting the statement if it be interpreted to mean that Leonardo helped Rustici during his stay in Florence from the autumn of 1507 to about the middle of 1508, when presumably the work was in process of being modelled in clay. The close association of the two is borne witness to by both Vasari and the Anonimo Gaddiano, and it would be strange if this did not produce counsel from Leonardo towards the work that was in progress. The statement which Vasari quotes as to Leonardo having worked upon it with his own hand has no weight of evidence to support it. The influence of Leonardo is, however, perceptible in the figure of the Levite – the bald, somewhat heavily built man on the right of St. John. The structure of the cranium reveals an anatomical knowledge akin to that of some of the heads in the Adoration. But this might come from counsel.

Rustici, who like Leonardo loved strange animals and kept them in his rooms, was also the soul of convivial Florence, and his rooms at the Sapienza was where societies of artists met and feasted. They were styled the Brotherhoods of the Cauldron and of the Trowel. The humours suffer somewhat by translation, but there was much mummery and some disguising of viands as a preliminary to consuming them. On one occasion, according to Vasari, the ceremonies opened with the entry of Ceres seeking Proserpine, who came to beg the men of the Trowel to attend her to the infernal regions. Pluto refuses to give her up, but invites them all to enter to attend his nuptials. To do

this they have to climb through the mouth of Cerberus, and are then in a circular room where they are put into their seats by a hideous devil. Round the room were painted caverns of the damned, showing their pains and torments, and flames were suddenly made to spring out in each. For a time the guests were tantalized by food disguised as repulsive animals and relics of death. Then on the command of Pluto the pains which had been suspended recommence, the lights are extinguished and groans and cries are heard, and finally the lights reappear and the real banquet commences. All this does not read impressively, but it would be rather more exciting to take part in it. My reason for the apparent digression is to air the possibility that Leonardo may have been present as a guest of Rustici, and that if so he was moved by the grisly humour of this spectacle of the chamber round which were painted the torments to write the *macabre* fragment which occurs on folio 231 *verso* of the British Museum manuscript, which was begun at the time of his association with Rustici. 'When Pluto's Paradise is opened,' it runs, 'then there may be devils placed in twelve pots in the manner of the mouths of hell. Here will be Death, the Furies, ashes, many naked children who are weeping; and living fires made of different colours. . . .' Some difficulty may arise from the question of date because Vasari, who says the banquet was at a meeting of the Trowel, gives the date of the origin of this Company as 1512. There is, however, evidence of Leonardo's presence in Florence in 1511 and as late as October 1513, and the manuscript in which the passage occurs, though begun in 1508, was not completed for several years; in fact some pages refer to work done or projected when in France.

In the letter which Louis XII wrote to the Florentine Signoria, urging the necessity of Leonardo's speedy return to Milan, he had described him as his painter and engineer in ordinary. The burden of his official duties, however, sat on him somewhat lightly. A small notebook known as

Manuscript F of the Institut, 'begun at Milan on the 12th of September 1508,' as is stated in a note on the opening page, offers a partial record of his activity during this period, and in it scientific interests have a marked predominance. The contents treat of the art of painting, anatomy, mechanics, optics, astronomy, botany, geology, hydraulics, and the flight of birds. A passage entitled 'the canal of the Martesana' on folio 76 shows him as engaged in devising a remedy for the diminution in the amount of water of the Adda available for irrigation since the construction of the canal, by the construction of a number of small channels. The Martesana canal had been constructed in the time of Francesco Sforza, and Ludovic in the early days of his power had formed the project of rendering it navigable as far as Lake Como. It is natural to connect with this intention on the part of Ludovic a passage in the Codice Atlantico 139 *verso*, with explanatory drawings of sluices, in which Leonardo enumerates the distance of the various stages of a canal beginning at Brivio and proceeding in the direction of Lecco, which would form the last division in Ludovic's plan. The work of making the Martesana navigable was carried out in the time of Ludovic, and Lancinus Curtius, the Milanese poet who wrote laudatory lines on the Sforza statue, congratulated the Duke on his having completed it. Leonardo's name is associated with twelve others on a list of engineers retained by the Duke and the civic authorities, and in the absence of further evidence it is not possible to say whose plan was the one chosen or who was the engineer who carried out the work. But it was Leonardo who, as has been shown in the passage already referred to, devised a method by which, when the canal had been made navigable, a sufficient quantity of the water of the Adda could still be available for purposes of irrigation. To this project are to be referred some of the studies of sluices in the Codice Atlantico. The carrying of it into execution, as also of the irrigation schemes in the Lomellina devised in the time of Ludo-

vic Sforza, have caused Leonardo's name to rank as one of the creators of the renowned fertility of the plain of Lombardy.

The course of the Martesana lay in an easterly direction from Milan as far as Vaprio, where it joined the Adda, which had flowed almost due south from Lecco on the eastern arm of Como. The Naviglio Grande, the other great canal of Milan, linked the city with the Ticino and Lake Maggiore by a line which proceeded first west and then north. Leonardo is connected with this canal by a carefully executed pen drawing washed with green and brown, in the Codice Atlantico, folio 387r., inscribed 'canal of San Cristofano at Milan, made on the third day of May 1509,' San Cristofano or Cristoforo being a district near Milan through which the Naviglio Grande flowed. The drawing represents a section of a canal, in the wall at the side of which are six sluices arranged in pairs one above another. The upper and lower sluices on the left, the upper sluice in the centre and the lower sluice on the right are open and streams of water are issuing from them. In a small drawing on the same page Leonardo has shown from another angle the course of the two streams which issue from the upper and lower sluices on the left, and we see the parabola of the stream which issues from the upper sluice crossing and recrossing the one that comes from the lower sluice before the two finally unite.

It serves to recall the various studies of waves and currents scattered through Leonardo's manuscripts, which are an index of the zeal he showed in investigating the laws and conditions of the movement of water, a subject upon which he subsequently compiled an exhaustive treatise, some parts of which occur in a more or less tentative form in Manuscript F of the Institut. Solmi interprets the inscription on the drawing, 'canal of S. Cristofano at Milan 3, May 1509,' as marking the date of completion of a dam and reservoir for the purpose of guarding Milan against danger from floods.

Louis XII granted to Leonardo as part of his official emoluments the right to take twelve inches of water from the said canal, the right however to be held in abeyance for a time on account of the dearth of water in the canal due to drought and to the fact that the outlets were not then regulated.

We owe our knowledge of the gift to drafts of letters in the Codice Atlantico, written by Leonardo from Florence, which were to be taken by his pupil Salai to the French Governor of Milan, the President of the Water Commission, and Francesco Melzi. In those to the Governor and Melzi their assistance was invoked in presenting Leonardo's case to the President of the Water Commission, to whom in his letter he recapitulated the circumstances which had existed when the gift was made, and cited the promise which had been made to him that he should be put into possession of these rights so soon as these circumstances had passed away, as a consequence of which, having been informed that the canal and its outlets are in order, he has already made several applications to the President without receiving any reply.

He refers also to the prospect of the termination of his lawsuit with his brothers, to his hope of returning to Milan by Easter and of taking with him two Madonna pictures, and in the draft of the letter to the French Governor he refers to his hope, when in possession of the water, of constructing instruments there and other things which will give great pleasure to the King.

Calvi, in his recent work on Leonardo's manuscripts, has cited the testimony of two contemporary chroniclers, one of Milan and one of Cremona, as to the unusual and prolonged drought that prevailed in Lombardy in the winter of 1506–7, and the latter chronicler also refers to the abundance of rain that fell in the early part of the year 1508. We may therefore follow Calvi in ascribing these draft letters of Leonardo to this latter year, and in concluding that the right to take twelve inches of water from the canal at San Cristoforo

when circumstances should permit, was awarded him, while the effects of the prolonged drought of the winter of 1506–7 were still visible, which they may have been as late certainly as May 1507, when Louis XII made his state entry into Milan.

How he availed himself of every opportunity to extend his practical knowledge in all that concerned the science of canalization may be shown by two references in a very miscellaneous page of notes in the Codice Atlantico, folio 222r, written while at Milan: 'the measurement of the canal, locks, and supports and large boats and the expense . . .' to this follow memoranda, 'a plan of Milan,' 'groups by Bramante,' 'Aristotle's Meteorology in Italian,' 'try to get Vitolone, which is in the library at Pavia and which treats of mathematics,' then 'he had a master who knows about water, and get him to explain about repairing it and what the repairs cost, and a lock and a canal and a mill in the Lombard fashion.' If the records attest his activity principally in repairs and alterations, rather than in constructive work, it must be remembered that most of the great canal system of Lombardy was already in existence when Leonardo first went to Milan.

While the dominant purpose with which he approached the study of water was scientific, aiming at results in hydraulics and canalization, the many studies and drawings of eddies and currents which occur in Manuscript F of the Institut, and in parts of other manuscripts which date from this Milanese period, show also the mind of the artist at work, following with all the old delight in rhythm and harmony of undulating form the bow of beauty carved by the mounting and falling wave, and the sinuous snake-like folds of the stream as it buries itself in slow death within the broad tranquil bosom of the river or sea. And some of the beauty seen in the moving masses of water lives in the studies, now at Windsor, made at this time for the Leda composition, in the closely encircling coils and rippling tresses of the hair.

Various passages in Manuscript F of the Institut, intended apparently to form part of the Treatise on Painting, treat of perspective and 'the effect of dark or light backgrounds on the apparent size of bodies,' and also of aerial perspective. The science of the artist's equipment and the chemistry of his materials seem to have interested him perennially, however intermittent his practice may have been. Indefatigable in his zeal for knowledge he was able to find new sources in the opportunities presented by the presence of French artists and men of letters at the court of Louis XII. And they on their side paid him homage: 'Léonard, qui a grâces supernes.' The name of the court painter Jean Perréal, or Jean de Paris, occurs three times in his manuscripts. The earliest, in a page of the Codice Atlantico (fol. 243r.), is a memorandum to 'get from Jean de Paris the method of painting in tempera.' The time references in the page on which this occurs are somewhat obscure. The opening sentences refer to a projected journey to Rome and Naples and to the necessity of his packing up his goods and selling what he could not take with him. Richter considers it to have been written before 1500, but it might, with perhaps equal if not greater probability, be connected with the closing period of Leonardo's service with Cæsar Borgia, and the desire to learn Jean de Paris's method of painting in tempera may have been expressed in anticipation of the problem which awaited him in the Anghiari composition. When at a later period Leonardo met Jean de Paris, who probably accompanied Louis XII to Milan in 1509, the mood of the scientist was dominant.

On the page of Milanese notes in the Codice Atlantico (folio 222r) on which he speaks of learning from an expert in the construction of canals, he refers to the measurement of the sun which had been promised him by Maestro Giovanni the Frenchman, and in a memorandum in one of the Windsor manuscripts (Richter 1412) he refers to the *Speculus* of Maestro Giovanni the Frenchman, the reference,

according to Solmi, being to the *Speculum naturale* of Vincent de Beauvais.

With this evidence of scientific information obtained by Leonardo from one of the members of the French court of Louis XII in Milan may be associated the reference in Manuscript K3 (folio 20a) to hydraulic work executed in the garden of the Château of Blois by Fra Giocondo, the Veronese architect.

The note, which is an entirely technical one, in explanation of a small diagram, is as follows: '*c d* is the garden of Blois; *a b* is the conduit of Blois made in France by Fra Giocondo, *b c* is what is lacking in the height of this conduit, *c d* is the height of the garden at Blois, *e f* is the fall of the siphon, *c b*, *e f*, *f g* is where the siphon discharges into the river.'

Fra Giocondo was one of the twenty-two Italians whom Charles VIII took back to France after his expedition to Naples in 1494, 'pour ouvrer de leur mestier à l'usaige et mode d'Itallye.' He stayed to work for his successor, and built two bridges over the Seine, one by Notre-Dame to replace the former bridge destroyed in 1499, the last arch of which was begun in the year 1507. The plan for the Château of Gaillon in Normandy, the residence of Cardinal d'Amboise, built in 1505, is attributed to him, and according to Vasari he made many works for Louis XII all over France, one of these no doubt being the conduit in the garden of the Château of Blois to which Leonardo's note refers. The exact time when he left France is uncertain. He was summoned to assist Venice in 1506, according to Milanesi, and there devised a plan for diverting part of the current of the Brenta to prevent the lagoons of Venice being filled with deposit, and in May 1509 was employed by the Republic to fortify Legnago by the use of the water of the Adige. He may have passed through Milan on his way south. It would be the natural route for anyone proceeding from France to Venice; and the French governor at Milan

was Chaumont, brother of the Cardinal d'Amboise. He would meet therefore with the welcome due to his attainments from the circle of the French court, and possibly Leonardo was of their number, or the latter may have made a note of the particulars of his work at Blois when told of it by someone who had been in France and then at Milan. It would seem, as Calvi says, that the form of expression in Leonardo's note, 'the conduit of Blois made in France by Fra Giocondo,' does not suggest that Leonardo wrote this note when in France, and therefore it does not offer any support to Amoretti's theory of Leonardo having paid a visit to France in 1505, nor to Uzielli's theory that the passage was written after 1515, when Leonardo was in France.

The theory of an earlier visit rests only on a passage in the Anonimo Gaddiano which, as Calvi says, 'offers evident chronological inversions.' The date of each of the three parts of Manuscript K, in the third of which the passage occurs, is given by Richter as after 1504. Calvi defines the period as between 1504 and 1509, the references extending from the time of Leonardo's studies for the Anghiari composition to that when his lawsuit was settled and he was again domiciled in Milan. Müller-Walde also considers that the third part of Manuscript K was composed in Milan. There it would seem, at the time when Leonardo, eager for knowledge, mingled with the French court, he wrote the note about the garden of Blois.

On rare occasions in the records of his studies, which form the only precise records of his activity during the five tranquil years passed at Milan when under French domination, a personal note may be discerned. Once in a rare mood of exultation, in the night watches, the scholar throws off his absorption, and seems to bid us share his transports at the discovery which he has made, following along the lines of pure mathematics which he had pursued so zealously at an earlier time with Fra Luca Pacioli. The passage occurs

in one of the as yet unpublished manuscripts at Windsor and may be found in Beltrami's Documenti e Memorie riguardanti la Vita e le Opere di L. da V. No. 201 (Windsor MSS. XVII, f. 7r.): 'After having long sought to square the angle with two curved sides, i.e. the angle *e* which has two curved sides of equal curvature, i.e. of a curvature proceeding from one and the same circle (drawn with the same radius), I have now on the eve of the Kalends of May 1509 discovered the principle at ten o'clock at night on Sunday.'

On the twenty-first day of October 1510 his name appears in the Annals of the Fabbrica del Duomo as one of a number of artists who were invited by the Commissioners to submit designs for the construction of choir stalls in the Cathedral, the others being Omodeo, Andrea da Fusina and Cristoforo Solari, Leonardo's name being distinguished from theirs by the title 'Maestro' and the description 'Fiorentino.' Whether he did submit a design or no is not known, but in any case he cannot have spent much time upon the work. The call of science was too imperative. Since the year 1506, when Marc Antonio della Torre left Padua to become professor of anatomy at Pavia, Leonardo had devoted himself with increased earnestness, 'con maggior cura,' as Vasari expresses it, to the study of human anatomy, in which the two, according to the same authority, mutually assisted and encouraged each other. On one of the many sheets of anatomical drawings and notes, now in the Royal Library at Windsor, Leonardo has written, 'during the winter of 1510 I look to finish all this anatomy.'

The hope thus confidently expressed was concerned with a subject upon which Leonardo had laboured for many years whenever opportunity offered. It had offered in Florence in his youth when he had seen Antonio Pollaiuolo's studies of the nude.

Vasari has borne tribute to Pollaiuolo's scientific study of anatomy, and states that he practised dissection and was the

first artist to investigate the action of the muscles in this manner. The influence of Pollaiuolo's work in the development of Leonardo's art at this time was considerable, and Horne has called attention to the Pallaiuolesque character of the male heads in Leonardo's anatomical drawings. Leonardo, according to the Anonimo Gaddiano, practised dissection in the hospital of S. Maria Nuova at Florence and made many drawings there, and it is natural to assume that it was at this same hospital that Pollaiuolo studied, and at the outset Leonardo may have assisted him. His study of anatomy was in inception subsidiary to the artistic purpose, a part of the artist's full equipment as he conceived it, so that he might be able to treat the essential verities of structure with first-hand knowledge, just as to represent rock formation aright he should know geology. The result is visible in the scientific realism of structure of the few artistic works of the first Florentine period, the emaciated figure of Saint Jerome, the many heads and figures dimly seen in the *grisaille* of the Adoration and the preparatory drawings for it. But it was continued in independence of the artistic purpose, with all a scientist's absorption and devotion to knowledge as the supreme aim. In one of the sheets of the Windsor manuscripts he says of his anatomical drawings, 'in order to obtain an exact and complete knowledge of these, I have dissected more than ten human bodies, destroying all the various members, and removing even the very smallest particles of the flesh which surrounded these veins without causing any effusion of blood other than the imperceptible bleeding of the capillary veins. And, as one single body did not suffice for so long a time, it was necessary to proceed by stages with so many bodies as would render my knowledge complete; and this I repeated twice over in order to discover the differences.'

Sabba da Castiglione refers to these studies as continued at the court of Il Moro: 'when he ought to have attended to painting, in which without doubt he would have proved a

new Apelles, he gave himself entirely to geometry, architecture and anatomy.'

It was this desire to render his knowledge complete that drew him back to the hospital of S. Maria Nuova to practise dissection on his return to Florence in 1500, and also as may be inferred from the statement of the Anonimo Gaddiano on his returning there from the Romagna and subsequently from Milan. To his preoccupation with anatomical studies at this time the Arundel manuscript and Manuscript F bear witness, and the references to such studies begin with a note at Windsor 'on the second of April 1489, book entitled "of the human figure" ' and extend to the year 1513. Lomazzo refers to a precept as occurring in Leonardo's Anatomy of the Human Body, but the treatise to which he refers may have been a compilation made by a pupil from the manuscripts as was the Treatise on Painting. That it was Leonardo's intention to write such a treatise is abundantly evident from the manuscripts at Windsor. Various alternative introductions entitled 'The order of the book' are among the most carefully finished of his writings. They show as it were a vast plan of the natural history of man adumbrating in his mind, of which the sheets at Windsor form severed leaves. In pursuit of it he made himself acquainted with all the accepted authorities.

A note 'the books of Avicenna' occurring among a list of names on the cover of Manuscript F affords an index of his studies at this time, and references are numerous to the works of the Arabian whose opinions then held the field in medicine. But he took nothing from authority, neither from Avicenna nor Mondino. All must be tested in the crucible. Thus he quotes from the Anatomy of Mondino as to the position of the muscles which raise the toes being on the outward side of the thigh and as to the absence of muscles in the back of the foot, and then the concluding words of the fragment are terse and trenchant: 'but here experience shows' . . .

Leonardo's studies in anatomy received great stimulus from the fact of his association with Marc Antonio della Torre. Vasari speaks of the two as mutually aiding each other, and this relationship may be deemed to have commenced in the year 1506, when Marc Antonio della Torre was summoned from Padua to found a school of anatomy at Pavia.

Both Vasari and Paolo Giovio refer to the latter as having written on anatomy, but nothing of his writing has survived. The fact, however, of his having been appointed to his office in his twenty-fifth year is a sufficient testimony to the outstanding nature of his intellectual powers.

From the fact that Leonardo was della Torre's senior by almost thirty years Müntz has supposed that he occupied the position of a master with a pupil in these researches; others have supposed the position reversed. It would, however, seem natural that in the case of two rare intellects working in unison towards a common purpose there would be neither master nor pupil in the ordinary sense of the terms, but Vasari is the chief authority for the relations of the two, and his account does award a distinct priority of rank to the work of Marc Antonio della Torre: 'he was one of the first, as I have heard say, who began to apply the doctrines of Galen to the elucidation of medical science, and to throw true light upon anatomy which up to that time had been plunged in the almost total darkness of ignorance. In this he was wonderfully aided by the talent and labour of Leonardo, who made a book drawn with red chalk and annotated with the pen, (of the subjects) which he dissected with his own hand and drew with the greatest diligence; wherein he showed all the structure of the bones, and added to these in order all the nerves and covered them with sets of muscles: the first attached to the bone, the second those that hold the body firm, the third those that move it.' . . .

Commenced, as has been stated, when della Torre was appointed to Pavia, these joint studies, which Leonardo

looked to finish in the winter of 1510, continued according to tradition at Vaprio, were only terminated in 1512 by the premature death of della Torre. That the association of the two should have taken the form it did despite thirty years difference in age is a signal instance of the intensity of Leonardo's devotion to knowledge. How ambitious the intended scope of his researches is shown in one of the passages in the Windsor Manuscripts entitled 'the order of the book':

'In twelve entire figures you will have set before you the cosmography of the lesser world on the same plan as before me was adopted by Ptolemy in his cosmography, and so I will afterwards divide them into limbs as he divided the whole into provinces; and then I will speak of the function of the parts in every direction, putting before your eyes a description of the whole figure and temperament of man as regards his movement by means of his different parts. And thus, if it please our great Author, I may demonstrate the nature of men and their customs in the way that I describe his figure.'

The complexity of the plan is perhaps a reason why, as with so many of Leonardo's undertakings, it remained unfinished.

Entries occurring in Jean d'Autun's Chronicles of Louis XII, respecting payments made to Leonardo da Vinci in the King's name for the years 1510 and 1511, show that his salary was paid regularly, his position in this respect while in the service of the French King differing from the conditions which prevailed at the court of Ludovic Sforza. Apparently his freedom to devote himself to whatever branch of study his inclination led was never greater than at this period, and to it should be referred the majority of such passages in his writings as are connected with visits to places in the mountainous parts of Lombardy and Piedmont.

In a note in the manuscript now in the Bibliothèque Nationale, entitled 'how in all travels one may learn,' Leonardo has said, 'this benign nature so provides that all over the world you find something to imitate.'

So we find that in all his travels, and they are many, he was always the curious, the interested observer eager to observe phenomena, studying atmospheric effects with a painter's eye for rhythm and colour, and a scientist's power to discern and co-ordinate significant details, as in a passage in the Leicester Manuscript, folio 28a: 'lately over Milan towards Lago Maggiore I saw a cloud in the form of an immense mountain, full of glowing rocks, because the rays of the sun, which was already close to the horizon and red, tinged it with its own colour. And this cloud attracted to itself all the little clouds that were near, while the large cloud did not move from its place, but retained on its summit the reflection of the sunlight for an hour and a half after sunset on account of its immense size; and about two hours after sunset there arose so violent a wind that it was a thing stupendous and unheard of.'

The passage occurs in a manuscript of a scientific nature, but the artist's vision predominates. The phenomena of the cloud in the form of an immense mountain full of glowing rocks is seen in a drawing of red chalk at Windsor, where it lies above a wide expanse of landscape which leads to a gateway of hills; some scene surely of where the Alps meet the Lombard plain. Wandering there he observed in the spirit of the true scientist the testimony of the rocks. 'At Alessandria della Paglia in Lombardy,' he says, 'there are no other stones for making lime but such as are mixed with an infinite number of things indigenous to the sea which is now more than two hundred miles away' (Leic. 10b). And in the same manuscript (Leic. 31a) he defines the importance of their evidence in words of balanced judgment between the dictates of research and authority:

'Since things are far more ancient than letters, it is not to be wondered at if in our days there exists no record of how the aforesaid seas extended over so many countries; and if moreover such record ever existed, the wars, the conflagra-

tions, the deluges of the waters, the changes in speech and habits have destroyed every vestige of the past. But sufficient for us is the testimony of things produced in the salt waters and now found again in the high mountains far from the seas.'

On another page of the Leicester Manuscript (folio 9b) he refers to the recent discovery of a prehistoric ship: 'at Candia in Lombardy near Alessandria della Paglia, while a well was being dug for Messer Gualtieri, the skeleton of a very large boat was found at a depth of about ten braccia; and as the wood was black and in good condition the said Messer Gualtieri decided to have the mouth of the well lengthened in such a way that the ends of the boat should be uncovered.' There is here no special mark of interest: nothing whatever to indicate that Leonardo attached any importance to the discovery as affecting that knowledge of past time and of the position of the earth which, he has written in the Codice Atlantico (373 *verso* a), 'is the adornment and the food of human minds.' In sharp contrast is the enthusiasm which he displays in the narration of the discovery of the skeleton of some great leviathan or antediluvian monster of the deep in a huge cavern among the mountains, the entry of which presents a picture not in essentials dissimilar to the record of daring of the first explorers of those wonders of Paleolithic art which lie hidden in the rock caverns of Dordogne: 'drawn by my eager desire, and anxious to see the great company of the varied and strange shapes made by creative nature, having wandered for some distance among the gloomy rocks, I came to the entrance of a great cavern, before which I remained for a while in stupefaction, being ignorant of the existence of such a thing. Bending my back into an arch and resting my left hand upon my knee, I made a shade for my lowered and half-shut eyes with my right; and frequently bending one way and another to see whether I could discover anything inside, and this being forbidden me by the

intense darkness within, and remaining thus for some time, suddenly there were awakened within me two emotions – fear and desire, – fear of the dark threatening cavern, desire to see whether there was within it any marvellous thing' . . . (Arundel Manuscript 263, folio 155r.).

With this passage that on the following page (Arundel folio 156r.), is obviously connected. In it Leonardo apostrophizes the spectacle which met his eyes within the cavern, conjures up the scene when the monster pursued its prey, and moralizes upon the inevitable mutability of all life. The concluding lines present the vision on which his eyes rested with elemental solemnity:

'O mighty and once living instrument of creative nature, thy great strength not availing thee, thou must needs abandon thy tranquil life in order to obey the law which God and time have ordained for all generative nature! To thee availed not the branching sturdy dorsal fins wherewith pursuing thy prey thou wert wont to plough thy way, tempestuously tearing open the briny waves with thy breast.

'O how many times the frightened shoals of dolphins and big tunny fish were seen to flee before thy insensate fury; and thou, lashing with thy swift branching fins and forked tail, didst create in the sea mist and sudden tempest, with loud uproar and foundering of ships; with mighty wave thou didst heap up the empty shores with the frightened and terrified fishes, which thus escaping from thee were left high and dry when the sea abandoned them, and became the plenteous and abundant spoil of the neighbouring peoples. . . .

'O time, swift despoiler of created things! How many kings, how many peoples hast thou brought low! How many changes of state and circumstance have followed since the wondrous form of this fish died here in this hollow, winding recess! Now destroyed by time patiently thou liest within this narrow space, and with thy bones despoiled and bare art

become an armour and support to the mountain which lies above thee.'

A note, dated the second day of January 1511, in Manuscript G of the Institut (folio 1v.) records a promise made by Master Benedetto the sculptor, whom Leonardo characterizes as 'il compare mio,' 'my friend or gossip' (Richter), to give him (for the sake of its colour) a tablet of a flaky stone which combines the whiteness of Carrara marble with the hardness of porphyry, and of which there is a quarry 'at Monbracco, above Saluzzo, a mile above the Certosa at the foot of Monte Viso.'

The sculptor Benedetto was in all probability, as Richter suggests, a native of northern Italy, who knew the place here described. He considers that the reference to the stone shows that Leonardo was not on the spot, but the description of the location of the quarry is so definite and circumstantial as to suggest first-hand knowledge.

That he made not only the Alpine valleys but on occasion the Alps themselves the scene of his researches is shown by a reference to an ascent of one, which may be found in the Leicester Manuscript (folio 4a).

The passage treats of the colour of the atmosphere, and the personal experience is introduced as showing how Leonardo became possessed of the requisite knowledge. After stating that the blueness which is visible in the atmosphere is not its own intrinsic colour, but is caused by warm vapour evaporated in minute and imperceptible particles on which the solar rays fall, causing them to become luminous against the deep intense darkness of the fiery sphere which forms a covering over them, he continues: 'this may be seen as I myself saw it by anyone who ascends Monboso, a peak of the Alps which divide France from Italy. The base of this mountain gives birth to the four rivers which flow in as many different directions through all Europe, and no mountain has its base at so great a height as this one, which lifts its head

almost above the clouds. Snow seldom falls there, but only hail in summer when the clouds are highest; and this hail remains there, so that if it were not for the infrequency of the clouds rising and discharging themselves, which does not happen twice in a summer,[1] there would be an enormous mass of ice there piled up by the layers of hail, which I found very thick at the middle of July. And I saw the atmosphere above me dark, and the sun as it struck the mountain was far brighter here than in the plains below, because there was a less thickness of atmosphere interposed between the summit of this mountain and the sun.'

On folio 36a of the same manuscript, after describing experiments with the smoke from dry wood and fine spray from distilled water for the purpose of showing that the blueness of the atmosphere is caused by the darkness beyond it, he states that these instances are given for those who cannot confirm his experiences on Monboso. The name Momboso is used for Monte Rosa in the *Italia Illustrata* of Flavio Biondo, published in 1474, and in Leandro Alberti's *Description de toute l'Italie*, which appeared in 1550. Uzielli in *L. da V. e le Alpi* has collected instances which show that the use of the term was general from this time until the eighteenth century. The name M. Bô is found on modern maps for the south-east spur of Monte Rosa. The statement as to the four great rivers having their source at the base and traversing Europe is an example of the tendency to the picturesque – the bane of early geographers – from one of whom Leonardo probably derived the idea. The names of the rivers are given in folio 10a as the Rhone, the Rhine, the Danube, and the Po. The comparison of the two passages shows that the remark should be interpreted as referring rather to the Alps in general as the meeting ground of the four great river basins than to a single mountain group. The statement about the increased brightness of the sun's rays upon the mountain is, as Freshfield has pointed out, a repetition of the idea as old

[1] MS. *età*, presumably for *estate*.

as Homer of eternal sunshine resting on the mountain's head; as, however, Leonardo is professedly relating an experience, confirmation of the accuracy of the phenomena which he observed, so far as it affects the credibility of his statement, tends directly to confirm it. The month of July, in the middle of which according to Leonardo the mountain was ascended, was probably from climatic conditions the most suitable month in the year for making such an expedition. The passages quoted contain a claim three times made that they are a record of experience. Thus after speaking of the effect of the sun's rays on vapour he says, 'this may be seen as I saw it by anyone going up Monboso.' After telling of the accumulation of the hail which falls there in summer he says, 'and this I found very thick at the middle of July.' Finally of the experiments with smoke and spray he says, 'they are given for those who cannot confirm my experience on Monboso.' To me this testimony seems conclusive of an actual ascent. It is not, however, expressly stated by Leonardo that he reached the actual summit of the mountain. He only says that he attained a sufficient height to enable him to observe certain physical phenomena in the colour of the firmament and the purity of the air and also in the snowfields and glaciers. The natural meaning of the word 'giogo,' as Freshfield has observed, is rather yoke or ridge than summit, and although the exact meaning of the word need not be pressed, there is nothing in the observations which Leonardo made which points to his having reached a height of more than from ten thousand to eleven thousand feet. That would have taken him up to the region of snowfields and glaciers. Perhaps it was with a view to the possibility of making such an expedition that he wrote the note which occurs among a page of notes connected with Milan in the Codice Atlantico: 'ask Benedetto Portinari how people go on the ice in Flanders.'

The evidence is not enough to justify any conclusions as to how far the ascent was carried. As Oberhummer observes,

'considering the structure of the Alps it seems incredible that Leonardo climbed one of the culminating peaks of the western Alps. At the most he probably reached the region of snow.' And this is as far as evidence takes us. As having gone so far he was certainly one of the earliest alpinists. That Monte Rosa was at a comparatively early date an object of attack by mountaineers is shown by the fact that on the rock above the Col d'Ollen, on the southern side of the mountain between Gressoney and Alagna, at a height of about ten thousand feet, are the initials A. T. N. and the date 1615.

Freshfield, with the authority of an alpinist, has disputed the accuracy of Leonardo's statement as to hail falling instead of snow, but a writer in the *Raccolta Vinciana* (*III*, *p*. 78) has suggested that it was the spectacle of the ice in the glacier by the Col d'Ollen which induced the belief in the mind of Leonardo that in the high regions of the Alps hail fell instead of snow.

Various other references show his familiarity with the hill-country of Lombardy.

In the Leicester Manuscript (folio 10b), in discussing the evidence presented by the fact of marine shells being found hundreds of miles from the sea as a factor against the universality of the deluge, he says: 'but how are we to account for the corals which are found every day towards Monte Ferrato in Lombardy, with holes of worms in them, sticking to the rocks which are left uncovered by the currents of rivers?'

So also in a somewhat cryptic sonnet written in the time of Il Moro by a Bergamasque poet, Guidotto Prestinari, who as representing the Lombard tradition resented the presence of the Tuscans whom Ludovic welcomed at his court, and was therefore the bitter foe of Bellincioni and Leonardo, the latter was made the butt of clumsy jests on account of his scientific researches, being held up to ridicule for spending his time in wandering about among the hills of Valcava near

Bergamo, where the Alps meet the Lombard plain, searching in the lonely woods for strange creatures and all kinds of curious worms.

Various topographical sketches at Windsor, representing the valleys of the Oglio and the Serio and the Bergamasque territory generally, have been assumed to have been prepared with a view to the extension of the existing system of canals in Lombardy, but, as Solmi has pointed out, they may serve to indicate that Leonardo was employed in the service of the armies of France and Milan in the war against Venice in 1509, which followed upon the League of Cambrai.

An entry, undated, in Manuscript K, 'Porto da Cassano,' where, in May 1509, Louis XII was joined by many of the Milanese nobility, has been thought to indicate that Leonardo was of the number, and the occurrence of the names Trezzo and Caravaggio, the one a place of concentration of the French army, the other a fortress which they stormed, serves perhaps to link his movements with the course of French military operations in his capacity as engineer.

After the objects of the League of Cambrai had been attained by the battle of Agnadello, Venice being forced to surrender her recently acquired territories, the League dissolved with the rapidity customary in all Italian alliances at this period. Julius II, having used the French as a means to humble Venice, now promptly joined with the republic, the Spaniards and the Swiss in a so-called Holy League against his former ally, and finally succeeded in bringing about the expulsion of the French from Italy. For a time, however, in the struggle that ensued, fortune favoured the French arms. Chaumont besieged Julius II in Bologna and almost effected his capture; and soon after Chaumont's death from fever at Correggio in February 1511, the command passed to Gaston de Foix, who, after a year of triumphs over the combined forces of the allies, was killed at the battle of Ravenna on the eleventh of April 1512. His death left the French leaderless. Their armies melted away, and one by one the fortresses

opened their gates to the armies of the League. Papal diplomacy had been active ever since its formation in endeavouring to obtain Swiss help to undermine the position of the French in Milan.

In December 1511 a Swiss army arrived within sight of the city, and messages were sent in the name of the Sforzas calling on the citizens to rise against foreign oppression. There was, however, no response, the castle being strongly fortified and held by the French garrison, and the Swiss therefore withdrew. Their retreat apparently was the occasion of acts of incendiarism. For Leonardo at this time made two notes in a page of the Windsor Manuscript (Richter 1022) which refer to the occurrences with laconic brevity:

'On the tenth day of December at nine o'clock a.m. the place was set on fire.

'On the eighteenth day of December 1511 at nine o'clock a.m. this second fire was kindled by the Swiss at Milan at the place called DCXC.'

With the text, according to Richter, there are sketches of smoke wreaths in red chalk.

A large Swiss force returned to Lombardy in May 1512, and on the twenty-ninth of December, with the help of Swiss and Spanish forces, Maximilian Sforza entered Milan. In his rule there he was never free from Swiss interference, but apart from this Leonardo, who had been in the pay of the French King, was definitely associated in the minds of the new rulers with the French occupation. There are no records of his further employment after the retreat of the French.

He may have remained for some time with the Melzi family at Vaprio, engaged in scientific researches. But the death of Julius II and the election of a Medici as Pope seemed to open up a new field of activity, and so within ten months of the return of the Sforzas he set out for Rome.

A note in Manuscript E (folio 1 *recto*) states: 'I departed from Milan for Rome, on the twenty-fourth day of September 1513, with Giovanni, Francesco de' Melzi, Salai, Lorenzo and il Fanfoia.'

Was it with any thought of such opportunities of art creation as had been offered in the Sistine Chapel under the Pope's predecessors that Leonardo turned his steps towards Rome, or did the hope of freedom from political vicissitudes and leisure to study in her libraries draw him thither?

The witness of earlier biography inclined to mirror some of the characteristics of Medicean Florence in Medicean Rome points to the former, that of the manuscripts to the latter alternative. That, however, something of art purpose was also present in Leonardo's mind is to be inferred from the fact that in a sentence written in a mood of dejection, probably at the end of the Roman period, 'li Medici mi creorono e disstrussono,' 'the Medici created and destroyed me,' he connects his fortunes with the Medici as being the earliest and the latest of his patrons, the first remark confirming the statement of the Anonimo Gaddiano as to his having been employed in his youth by Lorenzo il Magnifico, the second referring to the fact that Leo X had failed to give him any commission, and to the death of his patron, Giuliano de' Medici, the Pope's brother, whom, according to Vasari, Leonardo accompanied to Rome at the time of the election of Giovanni de' Medici as Pope.

A period of at least six months must, however, have elapsed between the Pope's election and the date of Leonardo's arrival in Rome. An entry of money paid to his account at the hospital of S. Maria Nuova shows that he was in Florence on the tenth of October 1513.

Giuliano de' Medici had already left for Rome, having been summoned there by the new Pope, who found him possessed of too much probity to serve the family fortunes in Florence. The festivities which had taken place on his enrolment in September as citizen and baron of Rome had shown the Pope's desire to foster the historic connection of the Tuscan city with Rome, as a preliminary to introducing the spirit of her art.

'I have three sons,' said Lorenzo il Magnifico, 'one good, one wise, and one foolish.' The eldest, Piero, by the folly of his rule in Florence, had sufficiently proved the truth of the last epithet, and the careers of Giuliano and Leo X were to confirm the first and second, the goodness of Giuliano being, however, too gentle to be fully effective, and the wisdom of Leo X having in it more than a little of the cunning of the serpent. That Giuliano de' Medici was in many ways a congenial patron for Leonardo may be inferred from the characterization of the former in his strength and weakness by the Florentine historian Vettori: 'he surrounded himself with ingenious men and wished to make trial of every new thing. Painters, sculptors, architects, alchemists, mining engineers were all hired by him at salaries which it was impossible to pay.' When and under what circumstances Leonardo first came into contact with this dreamer and would-be Maecenas, whose features are preserved in Michelangelo's famous marble, is not known, but at the beginning of December 1513 he was established in rooms in the Belvedere of the Vatican. An entry in a book of accounts shows that the official architect Giuliano Leno was employed then in erecting a partition and making various changes in the rooms occupied by Leonardo da Vinci. They were provided for him by his patron, as we know from a note in the Codice Atlantico (folio 90 *verso*) of the following July, in which he announced that a section of mathematical studies which treated of the squaring of curved surfaces had been 'finished on the 7th day of July at the twenty-third hour at the Belvedere in the study made for me by the Magnifico (Giuliano de' Medici).'

That Leo X expected some artistic result from Leonardo's presence in Rome is to be inferred from the fact of his having been given rooms in the Vatican and from Giuliano Leno having been employed to make alterations for his comfort, but his hopes were doomed to disappointment. Leonardo had temperamental sympathies with his patron,

being responsive to every mood of his strangely assorted nature. Philosophy and alchemy formed two of his principal interests, and among the instances which Vasari gives of Leonardo's participation in the latter category are the figures of animals formed of a paste made from wax which flew through the air when inflated, the fashioning of wings for a lizard found by the vine-dresser of the Belvedere which, being filled with quicksilver, trembled as it walked, and the bladders of sheep which, on being inflated, served the whim of their creator as emblems of genius which transcends space. 'He made an infinite number of such follies,' says Vasari – and his stricture in this instance is not to be wondered at – 'gave his attention to mirrors, and tried the strangest methods in seeking out oils for painting and varnishes for preserving works when executed.' It was not for trifles such as these, and endless experiments in technique, that the rooms in the Vatican had been made ready for the painter of the Last Supper. To the mind of the Pope Leonardo came perhaps to share something of the impracticability of his patron Giuliano. There is record by Vasari of a work having been given him to execute by the Pope, and of the remark made by the latter on hearing that Leonardo had begun to distil oils and herbs for the varnish: 'alas, he will never do anything, for he commences by thinking about the end before the beginning of the work.' Various other causes contributed probably to produce a feeling of estrangement. One was the fact that the practice of anatomical study which Leonardo resumed whenever circumstances permitted, and which he carried on in the hospital at Rome, was reported by an apprentice to the Pope in such a way as to prejudice the latter against him. Leonardo bears testimony to this in one of the fragments of letters written to his patron while the latter lay sick at Fiesole, in which he tells him of various thefts and malpractices of two of his assistants. It begins: 'this other has hindered me in anatomy, blaming it before the Pope, and also at the hospital' (Codice Atlantico, fol. 182v.).

Another cause may have arisen out of the rivalry which had long existed between Leonardo and Michelangelo which would tend to belittle the reputation of the former. The enmity had left Leonardo untroubled in Florence, but by reason of his work in the Sistine Michelangelo had already conquered Rome.

Vasari connects Leonardo's departure from Rome with the report of the Pope having summoned Michelangelo to return there, but his account is historically inaccurate in that he makes his leaving Florence depend on the permission of Giuliano, who at the time was already dead.

Leonardo had the less motive for remaining because of this event, which took place in Fiesole on the seventeenth of March 1516. It relieved a tension which might in time have become more acute. The primary object of papal policy at this time being the establishment of the Medici family, Giuliano de' Medici was not sufficiently malleable to be used for this end, his probity or goodness being, as Creighton says, an obstacle in the Pope's way. He had left Rome in January 1515 to go to Savoy to marry a French princess. Leonardo mentions the fact in a note in Manuscript G and adds that on that day news arrived of the death of Louis XII. He had returned at the end of February, and a document preserved among the *Carte Strozziane* at Florence, quoted by Solmi, shows that Leonardo was attached to his household after his marriage with Filiberta of Savoy, his name appearing there among a group of courtiers. Giuliano had been created Gonfalonier of the Church, soldiering needing less finesse than statecraft, and was sent in July 1515 in command of the papal troops to watch the movements of Francis I, who with a large army was preparing for the invasion of Lombardy, and if necessary to defend Parma Piacenza, Modena, and the other papal cities of which he was governor from French attack. Solmi conjectures that Leonardo left Rome in his company, and that when Giuliano de' Medici fell ill and abandoned the papal army at Florence,

retiring to Fiesole where he died, he left Leonardo with the papal army under the care of his nephew Lorenzo di Pier Francesco de' Medici.

According to Solmi the two may be identified as conversing together in one of Vasari's frescoes in the Pitti Palace. The four drafts of letters from Leonardo to his patron which are found in the Codice Atlantico seem, however, entirely to forbid the supposition that Leonardo accompanied Giuliano de' Medici on his departure from Rome. Referring as they do to his illness and congratulating him upon what was apparently a temporary measure of recovery, they are undoubtedly written in Rome after the Magnifico had left, during the eight months which elapsed between the time of his falling sick in Florence and his death at Fiesole. They reveal the circumstances of his life in the Vatican with illuminating wealth of detail, and the picture which they leave in the mind forms, as Richter has said, a striking contrast to the contemporary life of Raphael at Rome. The latter lived a life of princely magnificence and luxury, while Leonardo, thirty-one years his senior, was constrained in sickness to appeal to his absent patron for help in a sea of troubles caused by foes of his own household.

The scholar's detachment and fixity of purpose are no more the dominating note. His talk about 'the wickedness of the German deceiver' – a rather exaggerated description of the misdeeds of one workman spurred on by the malignity of another – serves to show that the fact that Leonardo did very little in Rome was due to loss of health and vigour as well as to circumstances. The various drafts of what is apparently the same letter reveal the importance to the mind of the writer of bringing the exact circumstances to the knowledge of his patron, to whom alone he can turn for help. He commences in courtier-like fashion by stating that the news of his Excellency's partial restoration to health has almost had the effect of banishing his own sickness, but it is not to this but to the actions of his workman that he attri-

butes the fact that he has not been able fully to satisfy his Excellency's desires. There follows a description of all that he has done to conciliate the said Giorgio, who neglects all his work and goes out to dine with the Swiss of the Pope's guard. 'There are idle fellows among them,' observes Leonardo, 'but he beats them all.' After dining they go out two or three together with guns and shoot birds among the ruins until nightfall; and when Leonardo sent Lorenzo to urge him to work he said that he would not have so many masters over him and that his work was for his Excellency's wardrobe. This went on for two months until Leonardo happened to meet an official of the wardrobe and inquired whether the German had finished his work, and was informed that he had only been given two guns to clean. When further urged he left the workshop and took his work to his own room, where he wasted his time making all sorts of tools and devices, which he hid if any of Leonardo's assistants entered, 'with a thousand oaths and mutterings so that none of them would go there any more.' He has wished also to make wooden models of what they were going to execute in iron in order that he might take them to his own country, and as Leonardo will only let him have the dimensions they remain at enmity. Behind him, encouraging him in all his acts, is another workman, Giovanni the mirror-maker, also a German, who is always in Leonardo's workshop wanting to know all that was being done and making it known outside and strongly criticizing it, and finally Leonardo has discovered that this Giovanni has two reasons for his hostility: the first being that he thinks that the fact of Leonardo having gone to the Vatican had deprived him of the countenance and favour of his Excellency which he had always enjoyed up to then; the second, that the ironworkers' room suited him for working at his mirrors, in proof of which Leonardo mentions the fact that besides making Giorgio his enemy Giovanni has induced him to sell all that he had and to leave his workshop and is himself working there with a number

of workmen making mirrors to send to the fairs. The crowning act of malice of this same Giovanni, more rancorous by reason of its greater efficacy, was that he had hindered Leonardo in anatomy by laying information before the Pope and also at the hospital. His industry at any rate suffered no reproach: 'he has filled this whole Belvedere,' says Leonardo, 'with workshops for mirrors, and he has done the same in the room of Maestro Giorgio.' It was all very disturbing, no doubt, and as regards the information about anatomy it was the more galling because, so far as can be discerned, Leonardo while in the Vatican had remained practically a stranger to the Pope, who was so well satisfied with Raphael's facile allegories of Attila shrinking in terror before his namesake and the like, that it scarce needed the breath of rumour or prejudice to convince him that nothing need with advantage be awaited from Leonardo. Twenty, even ten, years earlier, Leonardo would either have ignored or routed the mechanics, but as it was all he could do or think of doing was to write a letter – plaintive, pathetic, to judge from the fragments – to his patron, to Giuliano de' Medici, who could do nothing to help him, for, as the sequel shows, he was at the time dying of phthisis in the Abbey of Fiesole; and then finally within a few months of writing he took the road north to follow him. Of all the disappointments that had lain in his path, and they were many, this of Rome was the most complete. He had painted very few pictures while there, but in these, though the scale was restricted, the old power was still present. Vasari tells of two for Baldassare Turini of Pescia, the Pope's Datary, one a small Madonna executed with infinite diligence and art, but already in Vasari's time much deteriorated either from some error on the part of those who prepared the ground or from some caprice in technique, the other a small picture of a boy, probably a Child Christ, which he characterizes as 'beautiful and graceful to a marvel'; Vasari saw both pictures in Pescia, and there record ends.

Benedetto Croce has pointed out the existence in a *Canzoniere* of Enea Irpino in the Royal Library of Parma of three sonnets written in honour of Costanza d'Avalos, Duchess of Francavilla, and of her portrait executed by Leonardo, the lady being apparently there represented as already mature, in widow's dress with a beautiful black veil. As being connected with the Colonna, Costanza would have the opportunity to be in Rome, and the work may therefore be assumed to have been painted during Leonardo's Roman period. The diarist Antonio de Beatis, who visited Leonardo in France, speaks of seeing a portrait of a certain Florentine lady done from the life at the request of the Magnificent Giuliano de' Medici, but it is most probable, despite the reference to Leonardo's patron, that the picture seen by de Beatis was not a work painted in Rome, but the Mona Lisa, which passed after Leonardo's death into the Royal Collection at Fontainebleau, where it was seen and described in 1625 by Cassiano del Pozzo. Among the pictures there seen was also the Leda, and both works were stated to be at Fontainebleau by Lomazzo in 1591.

The date of the Leda composition has been assigned to the Roman period. Whether or no Leonardo actually executed the picture, or only made drawings for it, and whether the description of Lomazzo, who classes it among his few completed works, really refers to a lost original, or to one of the many versions of the subject by pupils, cannot be determined from the evidence now available for consideration. The fact that Raphael made a drawing, now at Windsor, which is apparently a copy of Leonardo's composition has been held to prove a Roman origin for the picture, but from the closeness of Raphael's drawing to the version in the Borghese Gallery, which Morelli with somewhat adventurous exactitude has assigned to Sodoma, it really proves nothing more than that this version of it was then in Rome. Some at any rate of Leonardo's studies for the composition date from the time of his life at Milan during the French

occupation. A fresco of a Madonna and Child at S. Onofrio, which may be ascribed on stylistic grounds to Boltraffio, completes the list of paintings attributed to Leonardo during his Roman period.

That other and more practical interests also occupied him during the Roman period is testified by various references in the manuscripts, but these are for the most part fugitive and desultory. A plan in the Codice Atlantico (96 v.a), inscribed 'stable for Il Magnifico,' refers to a projected work for his patron. That Leonardo had bestowed much thought to the peculiar necessities of this particular branch of architecture is shown by a long passage in Manuscript B (folio 39a), written probably during his first period at Milan, entitled 'how to make a clean stable,' in which he considers the arrangement and construction in great detail from the point of view of hygiene, the note being accompanied by an elaborate architectural drawing. On the same sheet as the plan for the stable for Giuliano are calculations for parts of cannons. It was at this time also that he was engaged in devising a mechanism for the coining of money. A page of Manuscript G (folio 43a) contains sketches of dies to be used for punching, and in the accompanying notes which bear the title 'the Mint at Rome' he states that the mechanism can also be made without a spring, provided that the piston above is always united to the part of the movable sheath, and then proceeds to specify in an entirely practical manner the processes necessary for securing perfection of rim, which he defines as the distinguishing feature of good coins. The technical nature of the note justifies the supposition that Leonardo's mechanism was actually used in the Mint at Rome.

Notes in the Codice Atlantico (folios 63v. and 227v.) mention the harbour of Civita Vecchia and Hadrian's Villa at Tivoli, presumably on the occasion of visits there, in the former case probably in his capacity as engineer. Another in Manuscript E (folio 80) records a visit to Parma on the

twenty-fifth of September 1514. This being one of the papal cities of which Giuliano had become governor, Leonardo's visit there may be connected with his patron's interests. His own surely are dominant in the memorandum in the Codice Atlantico (folio 92r.) to learn the precise locality of the fossil shells on Monte Mario, the old love of geological research which had led him to explore the sand deposits of the upper valley of the Arno finding here a fresh field for endeavour. A note in the Codice Atlantico (folio 65r.), 'of the sounds which may be made in the water, as for instance above the ditch of Sant' Angelo,' has been considered by Solmi and de Toni to show that Leonardo was engaged while in Rome in conducting experiments in acoustics, the reference being interpreted as being to the Castle of S. Angelo. Calvi, however, following Cermenati, has shown that the reference is to the church of Sant' Angelo at Milan, which is situated near to the Naviglio Grande, there being also a reference to this canal on the same page of Leonardo's manuscript. A date on one of the sheets of anatomical manuscripts at Windsor shows he still recorded the results of research in anatomy while at Rome. He was occupied while there in the study of optics, and on one occasion the joys of mathematical study moved him to expression. A note in the Codice Atlantico (folio 172v.) of the dimensions of the church of S. Paolo shows him to have been in Rome as late as August 1516. An entry on folio 103r. of the same manuscript, 'Ascension Day in Amboise 1517 May at Cloux,' attests no less clearly his presence in France. He must, therefore, as Seidlitz says, have crossed the Alps either in the autumn of 1516 or the spring of 1517. Solmi, who has apparently overlooked the significance of the dated note of the dimensions of the church of S. Paolo, assumes that Leonardo left Rome in 1515 and was present at the Concordat held at Bologna in December between Leo X and the victor of Marignano, Francis the First, and that after the three days' conference had ended on the fifteenth of

December Leonardo accompanied Francis northwards. A list of the names of towns between Piacenza and Bologna which occurs in the Codice Atlantico he would regard as indicating the route followed on this occasion.

There is also a somewhat puzzling piece of evidence as to Leonardo's movements at this time in a letter published in Beltrami's Documenti No. 232, purporting to be written by Leonardo from Milan on the ninth of December 1515 to his steward at Fiesole about the management of his vineyard, but as the location of the letter has now been unknown for more than a hundred years the question of its authenticity cannot be determined. It cannot in any case lessen the importance of the note already quoted from the Codice Atlantico as fixing Leonardo's presence in Rome as late as August 1516.

CANNON FOUNDRY

FRANCE

At the time of Leonardo's removal to France he had already passed the grand climacteric. Life had no new adventures for him. The closing of the Roman episode in utter and complete failure had finally extinguished the hope of finding a congenial sphere in Italy. He knew that there was there no continuing city by reason of political conditions, and he turned to follow Francis the First with something perhaps of the same detachment from former things as had animated the navigator Ponce de Leon a few years earlier when he set out to find the fabulous Isle of Bimini and in the search discovered Florida. A decline of physical powers had already begun to make itself manifest, closing altogether some activities, and lessening others. His offices in the King's household were the same as those he held during the French occupation of Milan, but now more than ever they were given rather as a recognition of what he had done than with thought that he would add to the sum of his labours, and yet, as the manuscripts show, there were activities projected and essayed during the years in France, and these of an entirely practical nature.

He was awarded by Francis the First the château of Cloux near Amboise as a residence. A vivid picture of his life there, of inestimable value as being the testimony of an eye-witness, has been preserved in the record of the travels of a certain Cardinal Luis of Aragon, half-brother of the King of Naples, who made a tour through northern Europe in the years 1516 and 1517 and visited Leonardo at Cloux. The manuscript, which has been edited by Pastor from the copy in the Royal Library at Naples, was written by the Cardinal's secretary, Antonio de Beatis.

'On the tenth of October 1517,' he says, 'Monsignor and the rest of us went to see, in one of the outlying parts of Amboise, Messer Lunardo Vinci the Florentine, an old man of more than seventy years, the most excellent painter of our

time, who showed his Excellency three pictures, one of a certain Florentine lady done from the life at the instance of the late Magnificent, Giuliano de' Medici, another of S. John the Baptist as a youth, and one of the Madonna and Child in the lap of S. Anne, all most perfect, and from whom, since he was then subject to a certain paralysis of the right hand, one could not expect any more good work. He has given good instruction to a Milanese pupil who works very well. And although the aforesaid Messer Lunardo cannot colour with the same sweetness as he used to he is still able to make drawings and to teach the others. This gentleman has written of anatomy with such detail, showing by illustrations the limbs, muscles, nerves, veins, ligaments, intestines, and whatever else there is to discuss in the bodies of men and women, in a way that has never yet been done by anyone else. All this we have seen with our own eyes; and he said that he had dissected more than thirty bodies, both of men and women, of all ages. He has also written of the nature of water, of divers machines and of other matters, which he has set down in an infinite number of volumes all in the vulgar tongue, which if they should be published will be profitable and very enjoyable.'

That there are here certain errors of fact scarcely, if at all, affects the importance of the narrative. Leonardo's age is overstated. He was only sixty-seven when he died. The portrait of the Florentine lady showed to the visitors was probably the Mona Lisa, but Giuliano de' Medici had nothing whatever to do with its inception. The descriptions of the other two pictures refer to those in the Louvre. These may conceivably have received the final touches after Leonardo went to France, although, as the chronicle states, at the time of the Cardinal of Aragon's visit the period of artistic achievement was over, the right hand being then stricken with disease, and no longer able to produce good work. The writer was one of a party who had seen and talked with

Leonardo and had been shown by him what he thought most worthy of their attention, and his narrative presents the earliest testimony of the extent and importance of the manuscripts. It was apparently the spectacle of the 'infinite number of volumes all in the vulgar tongue which if they should be published will be profitable and very enjoyable' that made the deepest impression upon the mind of the observer. Four hundred years have barely sufficed for the realization of the truth of his prophecy.

The section of the manuscripts which he scrutinized most carefully was that which treated of anatomy. This would seem to have had such a special interest for him as almost to suggest special knowledge. It led him to formulate such an expression of belief in the consequence of Leonardo's researches as was only paralleled some three hundred years later by the verdict of the great anatomist William Hunter, who, after studying the sheets in the Royal Library, wrote that he was fully persuaded that Leonardo was the best anatomist at that time in the world. The only other subjects mentioned as treated of in the infinite number of volumes which so impressed the visitors are the nature of water and divers machines. The reference in the first instance is to the manuscript now in the library of Lord Leicester, which bears the title 'on the nature, weight and motion of water.' It is a natural inference that Leonardo at the time of the visit of the Cardinal of Aragon was already occupied with the preparation for those schemes of canalization which transcend in importance any other project of this last period, and that in this connection the treatise on water, which tradition connects with his work on the Martesana Canal, and the plans of divers machines in the Codice Atlantico and elsewhere, may have been at hand because Leonardo was at the time studying plans of hydraulic works prepared for use in Lombardy and Tuscany, in order to consider their possible application for his work in the region of the Loire.

The evidence of this project – it does not appear that it

was anything more – is contained in various passages in the British Museum Manuscript which have been transcribed by Dr. Richter. The ultimate range of purpose contemplated apparently the joining of the waters of the Loire and the Saône by means of a canal with locks. On a page of the Codice Atlantico (folio 336 *verso* b), which, from the fact that it is there stated that Leonardo returned to Amboise from Romorantin on the evening before St. Antony's Day, and that the King had left Romorantin two days previously, may be presumed to have been written immediately after a meeting of the two at Romorantin at which the details of the project were discussed, there are two rapid hydrographic plans, one of the Loire and its tributaries with various names, inserted as Loire, Cher, bridge of Sauldre, Villefranche, sandbank, Sauldre, and another which contains the names of Tours, Amboise, Blois, Mont-Richard, and at the end of a long direction-line – Lyon, thus showing apparently the objective of a proposed canal. By the side of this is the note, 'you will make an experiment of the level of this canal, proceeding from the Loire to Romorantin by a canal one braccio wide and one braccio deep.' The construction of this portion, which was apparently in intention a stage towards the larger project, is discussed in various passages in the British Museum Manuscript (Arundel 263), in one of which the connection between the two schemes is specifically stated, thus 'in order to make the great canal first make the smaller one and conduct into it the water which by a wheel will help to fill the great one' (Arundel, folio 149a). On the page of the Codice Atlantico which contains these plans is a calculation of the fall necessary to give the requisite momentum to the current of the water in the canals, this being estimated as one and a half braccia, or about two and a quarter feet per mile; and this enables him to calculate the volume which would be transferred from the Cher at Villefranche to the Sauldre at Romorantin by means of this canal – the number, however, being missing in the manuscript.

'Where one river,' he continues, 'by reason of its lower level cannot flow into another it becomes necessary to dam it up to such a height that it may be able to fall into the other which was previously the higher.' The locality intended becomes clear from a passage in the British Museum Manuscript (folio 269b), which also indicates the intended use of the water of the canal for purposes of irrigation: 'The water may be dammed up above the level of Romorantin to such a height that in its fall it may be used for many miles. The river at Villefranche may be conducted to Romorantin, which may be done by the inhabitants; and the timber of which the houses are built may be carried in boats to Romorantin. The river may be dammed up at such a height that the water may be brought back to Romorantin with a convenient fall.' On the same page he discusses the most suitable size of the wheel for raising the water. On the reverse of the sheet (folio 269a) is a sketch map of the Loire at Amboise showing the islands, on one of which a part of the town is built, and in an accompanying note he calculates their effect on the currents of the river when there is a smaller or larger volume of water, these observations being made probably, as Dr. Richter conjectures, after he had resided for some time at or near Amboise.

On the reverse of the following page (folio 270b) the advantages which would accrue from the canal are further discussed. The river described as *m n* in a small sketch map which illustrates the text is apparently the Beuvron which joins the Loire above Blois, and the canal which should join its waters with those of the Sauldre at Romorantin would apparently form a continuation of that already referred to from Romorantin to Villefranche on the Cher. 'If,' it runs, 'the river *m n* an affluent of the river Loire were turned with its muddy waters into the river of Romorantin, this would fatten the land which it would irrigate, and would render the country fertile to nourish the inhabitants, and would make a canal navigable and suitable for commerce.' In

describing how the river in its flow should scour its own channel he defines the action of the river on its own channel to be that the more rapid it is the more it wears the channel away, and the slower the movement of the water the more it deposits that which renders it turbid. The passage which follows shows this undertaking as linked in the mind of its author with his work in the Veneto, and is of primary importance as revealing the fact of Leonardo having been engaged in that work: 'and let the sluice,' he says, 'be movable, like the one I arranged in Friuli where when one sluice was opened the water which issued forth from it hollowed out the bottom.' 'When therefore,' he continues, 'the rivers are flooded, the sluices of the mills ought to be opened, in order that the whole force of the river may pass through the sluice to each mill; there should be many, in order to give a greater impetus, and in this way the whole river will be scoured; and let there be one of the sluices below the site of each of the two mills.'

There is also a reference to the Loire in the Leicester Manuscript (folio 9a), but this apparently was written before Leonardo went to France. He there puts into the mouth of an imaginary opponent of his theory that marine shells found at a distance from the sea prove that at one time the waters covered the earth, the statement that such shells are found in the plain of the Loire at a distance of eighty miles from the sea, and that these may have been carried there by the sea, which rises about twenty braccia with the tide and covers more than eighty miles of country since it is a wide plain.

Leonardo goes on to state that these conditions do not obtain in the Mediterranean, since the tide there varies but little, and when this is so it covers little of the country. The instances on which his theory was built up are of places where the Mediterranean forms the sea-board.

On one of the pages in the British Museum Manuscript (folio 270b), which contain notes on the construction of

canals in the region of the Loire, there are notes and plans for buildings, which show that while in France he was also occupied with architectural work. Although the partial paralysis of the hand of which de Beatis makes mention had closed the possibility of fresh artistic work, the brain could still devise and the hand register. One of these, which bears the title 'changed arrangement' (mutatione) 'of houses' seems in some details almost to anticipate the conditions of standardization consequent upon modern mass production. 'Let the houses,' he says, 'be changed and arranged in order, and this will easily be done when they are first made in parts on the open places and then the framework can be fitted together on the site where they are to be permanent. Let the country folk inhabit a part of the new houses when the court is not present.' The note is accompanied by four sketches or ground plans of approximately similar shape and dimensions. In two of these eight rooms or compartments, alternately square and circular, are seen grouped round a central space; the others are divided round the edge in segments of circles; in the one alternately projecting, while in the other, which is in part shaded, they are inset. The two former are apparently sketches of a ground plan, the latter of the ceiling and roof to correspond, and the method of construction which has been employed seems quite in accord with the reference in the text to the houses being made in parts and then assembled on the site where they are to be. The reference to the court in the accompanying note would seem naturally to support the inference that the houses were to be erected at Amboise, but the fact of Leonardo having met the King at Romorantin, to which he refers in a passage already quoted from the Codice Atlantico, harmonizes with the suggestion of Seidlitz that the plans may have been intended to serve for a hunting-box for Francis the First at Romorantin. There is a further reference to Romorantin in the passage that follows, in which, accompanying a ground plan of a rectangular

walled town through which water is flowing, is a note: 'the river which flows through this place will take no turbid water, but this water will be led through the trenches that enclose the town by four mills at the entrance and four at the exit, and this may be done by damming the water above at Romorantin. And at every piazza let there be fountains made.' Whether the town indicated is Romorantin or some place lower down the Sauldre is not very clear from the text, but it seems more probable that he means the former as it was the site of much of his projected activity as an engineer.

There is also an important example of his architectural schemes in a drawing in the Codice Atlantico on folio 75b, where he has represented the ground plan of a rectangular turreted castle of large dimensions, the measurements of the inner court being 80 by 120 braccia, and the moat which surrounds it being of a breadth of 40 braccia. Adjacent on the right is a large rectangular basin or tank of approximately 80 by 240 braccia, in which an inscription – 'jousting in boats, that is the combatants are to be in boats' – shows that it was intended that it should be used for aquatic tournaments. A note on the left of the castle, 'the road to Amboise,' points to the date of the drawing as being during Leonardo's residence in France. The dimensions as given in the plan are such as to suggest a royal residence, and this is confirmed by the first of the accompanying notes, which states that 'the palace of the prince must have a piazza in front of it.' Probably the design was for a pleasure palace intended exclusively for sport and entertainment.

So the lake was to be used for tournaments, and the same purpose is seen in the notes that follow, e.g. he states that houses intended for dancing or jumping or any other movements with a multitude of people must be all on the ground floor, and speaks of having been a spectator of the destruction of some which have caused many deaths. In the other notes he touches cursorily on many matters of practical importance

in the construction of such a building: thus every wall, however thin, must either rest on the ground or on arches with a strong foundation; the mezzanines should be vaulted and the vaults be stronger in proportion as they are of small size; their walls should be of thin brick instead of wood for fear of fire, and for the same reason the ties of oak should be enclosed in the walls; the closets should be numerous and have proper ventilation by shafts in the walls so as to exhale by the roofs. There is much forethought of practical detail in these notes, but whether the plan went any further, or whether there was any measure of attainment, we cannot even conjecture. If the design never saw fruition this was not due to any inherent defect, but simply to contingent circumstances. If, on the other hand, something of it was accomplished, time has been ruthless, as elsewhere with Leonardo's work; but palaces and hunting-boxes such as these would hardly be of a structure to withstand its ravages.

The note in Manuscript K about the conduit made by Fra Giocondo in the garden of the château at Blois, to which reference has already been made, was probably written before Leonardo went to France. It may have been based upon information supplied either by Fra Giocondo or one of the French Court at Milan. Referring as it does to a deficiency in the height of the conduit, it may very probably have been written with the intention of preparing a plan to remedy the defect. In any case it shows Leonardo's interest already active in constructional problems in the château of Blois which during the reign of Francis the First was the scene of much architectural activity. There between the years 1516 and 1519, that is at the time of Leonardo's residence at Amboise, some twenty miles away, the spiral staircase was built in the new wing which bore the King's name. There is no direct evidence as to its authorship, and in the absence of any such there must be an element of uncertainty in any conclusions. Sir Theodore Cook, however, in his study of spiral formations, to which he has given the name 'The

Curves of Life,' has advanced various reasons, the cumulative effect of which is very striking, why the design should be attributed to Leonardo. He assumes that the form of the open spiral staircase was suggested to its author by a shell, and in support of this theory he adduces photographs which show a functional similarity of design as existing both in the internal and external lines of staircase and shell. Granting this hypothesis, facts and inferences fall into line with rare uniformity. The shell in question is the *voluta vespertilio* which is found on the north-west coast of Italy. Presumably therefore the staircase was designed by an Italian and by one who had studied shells and spiral formations. The fact of the staircase being a left-hand spiral indicates either that it was taken from the rare sinistral form of the shell or was drawn by a man who was left-handed. As though in witness of this origin, the motive most prominent in the carvings between the fluted columns of the central shaft of the staircase is a shell. So also in the case of the steps the design is a natural form. They are cut, as Sir Theodore Cook points out, in a double curve like the outline of a leaf. When, with these characteristics in mind, we look for a possible author, the quest is not of long duration. During just those three years within which the staircase was constructed Leonardo was living only a score of miles away. He was in the service of the King, who caused the wing of the château of Blois which contains the staircase to be built. He worked with his left hand. Many drawings in his manuscripts, and specially in the Codice Atlantico and at Windsor, serve to show that he studied with rare devotion the curves of leaf and plant, the spiral formations of shells, of rippling hair, of falling water and curling smoke, and even drew a spiral staircase. To do anything like justice to the skill with which Sir Theodore Cook presents his theory one must needs study his illustrations. They support the conjecture that Leonardo with his unique combination of knowledge, being where he was at the time when the staircase was constructed, must have been

at the making, but in the lack of direct evidence of this there remains an element of doubt as to his share in execution, perhaps by reason of the fact that while, as his manuscripts show, he was still devising new things in canalization and as an architect, there are no record of any work projected in France being carried to completion.

The list of his activities during this period has been added to by Solmi on the strength of certain descriptions of ceremonies at the French Court written by various Italians to Federico Gonzaga and now contained in the Mantuan Archives. It transpires from the first of these – a letter from Rinaldo Ariosto, written at Argentan in Normandy on the first of October 1517 – that at the close of the previous month the King of France had gone there with his Court on a visit to his sister Margaret of Valois, wife of the Duke of Alençon, and that a *festa* had been held on the occasion of his entry in which there had been a mechanical lion which, on the King striking it with a rod presented to him by a hermit, had opened and was seen to be all blue within. A letter written two days later by Anastasio Turrioni also contains a description of the ceremonies, and the lion is also mentioned, the inside being said to be blue, with a lily in the centre. The fact that both Vasari and Lomazzo mention the construction of a mechanical lion by Leonardo has caused Solmi to conclude that this was the occasion to which they refer, and that Leonardo was present and took an active part in the ceremonies at Argentan on the occasion of the King's visit.

Similarly two accounts in the Mantuan Archives of festivities at Amboise, written on the third and sixteenth of May 1518, by a certain Stazio Gadio, the first being to celebrate the baptism of the Dauphin and the marriage of Lorenzo de' Medici with the King's niece, Madeleine de la Tour d'Auvergne, the second an account of a mimic siege and capture of a castle, offer according to Solmi so many analogies with passages in Leonardo's manuscripts and the

life by Vasari as to warrant the conclusion that on each of these occasions Leonardo had a share in organizing the ceremonies. A fifth piece of evidence according to the same authority of Leonardo's participation in court ceremonies is probably afforded by a letter which is to be found in the Diaries of Marin Sanuto (tom. XXV, c. 510), written from Amboise on the nineteenth of June 1518 by a certain Galeazzo Visconti, which contains a description of a scenic representation held in the castle of Cloux, in which the sun, moon and planets were represented, the necessary apparatus being, he presumes, similar to that which was set up on the thirteenth of January 1490 in the Castle of the Porta Giovia at Milan, when Leonardo designed figures to accompany a representation of Bellincioni's Masque 'Il Paradiso,' as part of the festivities at the wedding of Isabella of Aragon with Gian Galeazzo.

While this presentation of evidence from manuscript records of the activities of the French Court during the time when Leonardo was in France has a real interest for the student their value as biographical documents is not great. No one of the five descriptions of ceremonies makes any reference either direct or indirect to Leonardo.

If the writers are, as Solmi believes, describing events in which he had taken part, or which he had organized or inspired, the omission is surely somewhat surprising – more especially so because the four writers were all Italians and were reporting ceremonies to an Italian prince, and Leonardo, who was 'premier peinctre et ingenieur et architecte du Roy,' was by far the most distinguished of the Italians then in France. The fact that he is not mentioned in any of the authorities whom Solmi cites seems entirely subversive of his theory.

He is constrained, moreover, apparently to interpret the statements of Vasari and Lomazzo as to Leonardo having constructed a mechanical lion as having reference to the ceremony at Argentan. Vasari, however, located the incident

in Milan. 'The King of France,' he says, 'came to Milan when Leonardo was there, and on his being requested for this reason to construct some unique thing he made a lion which walked several paces and then opened its breast and showed it full of lilies.' Accepting his statement as accurate it would seem most probable that the occasion was, as Müller-Walde suggests, the triumphal entry of Louis XII into Milan in July 1509, after the victory of Agnadello. Leonardo was then at Milan in French service, and it is hard to see how he could have avoided being called upon to do something to mark the event. There is perhaps some confirmation of this in the fact that sketches of an automatic lion with wheels on its feet are to be found in the Codice Atlantico on folio 179 *recto*, and that the same page also contains a study in chalk for the thumb and uplifted forefinger of the right hand of the St. John the Baptist in the Louvre, which is usually regarded as a work of the later Milanese period. Lomazzo's account does not state where the incident took place. He says that Francesco Melzi told him that Leonardo used to make artificial birds out of a certain substance which flew through the air, and that once in the presence of Francis the First he made a lion, constructed with marvellous subtlety, which walked from its place in a room and then stopped and opened its breast, which was full of lilies and other flowers. From the mention of Francis the First the incident may have taken place either in France or at Milan as the King and Leonardo may have met there.

Possibly, as Lomazzo's information was derived from Francesco Melzi who was with Leonardo in both places, he may have confused two different incidents. His account does not agree in detail either with those of the Gonzaga's correspondents or of Marin Sanuto, who describes the same *festa*. In these the lion is introduced as part of a masque in which the King is the protagonist. He attacks it and overcomes it and so wins his way into a castle. On his giving it three blows with a rod the breast opens and the

colour visible inside is blue, according to one of the Gonzaga's correspondents, and blue with a single lily, according to the other. In the narratives of Vasari and Lomazzo it is the lion which does the movement. It takes steps forward apparently to welcome the King and then shows its breast filled with lilies. The fleur-de-lis as an emblem would naturally figure in all pageantry at the French Court. The two sets of narratives are so divergent that they cannot be considered as referring to the same incident, and therefore there is really no evidence to support the assumption that Leonardo was at Argentan.

So in like manner the parallel which it is sought to establish between Stazio Gadio's account of the tournament at Amboise in May 1518 and his despatch of the same month about the mimic contest for a castle, and various passages in Vasari and in Leonardo's manuscripts, seems to lack reality. Leonardo devised numberless costumes and masks for pageants, he made toy balloons filled with air which were shot from mortars, he studied each and every sort of war machine, but the coincidences are all either too slight or too obvious to serve as the base of any theory as to Leonardo having taken any part in organizing these events. Nor does the letter of Galeazzo Visconti altogether justify the construction placed upon it. It does describe a scenic representation of Paradise and the planets held at Cloux in the presence of the King, and this by reason of its theme may naturally be linked in thought with that representation which took place at Milan in 1490 in a hall of the Castello di Porta Giovia, when Leonardo constructed the machinery and devised the costumes for the figures of the planets, and Bernardo Bellincioni's apt muse composed the words of the masque that formed a part of the ceremonies arranged by Ludovic Sforza on the occasion of the wedding of Isabella of Aragon and Gian Galeazzo.

In this masque the planets came to felicitate with courtly words the poor Duchess, who was to find out soon that despite

all their flatteries she and the Duke her husband were doomed to live as puppets, while the power that should rightfully have been theirs lay in the hands of Il Moro. If, as would seem wellnigh inevitable, Leonardo was not only present at the scenic representation held in honour of the King in the palace of Cloux in June 1518, since it was there that the King had appointed his residence, but was actively concerned in the preparations for it, and if with the same planets reappearing as in the masque for which Bellincioni's words were written, it fell to him to design the properties, he would construct surely on the same lines as the old so far as memory served after the passing of eight-and-thirty years. Not, however, to these trappings, but to the actors in the days they served to recall, the actors before whom the masque had been played, thought would needs turn insistent when the masque was held at Cloux. The long pageant of the Sforza court, princes and princesses, condottieri, poets, painters, passed before him. With all time had dealt capriciously: bringing Leonardo after much wandering to quiet anchorage within twenty miles of the spot where his old patron – the would-be arbiter of the destinies of all – had died in captivity. Leonardo's presence at Cloux a few days after the date of Galeazzo Visconti's despatch is attested by a dated note on folio 249r.a of the Codice Atlantico, where among geometrical calculations Leonardo has written: 'on the twenty-fourth of June, St. John's Day, 1518, at Amboise in the palace of Cloux.'

This, the latest dated note in the manuscripts, is probably the latest fragment of his writing which exists. The mention of St. John's Day may, as Solmi suggests, have been due to the fact that it evoked memories of his own distant country. A letter written from Amboise by Francesco Melzi, on the first of June 1519, to Ser Giuliano da Vinci and the other brothers of Leonardo, announces the fact of his death having taken place on the second day of the previous month – the second of May 1519.

Vasari, in his brief account of the French years, speaks of the great favour shown to Leonardo by the King who, according to him, was already the possessor of some of his works, and wished him to execute in colour the cartoon of St. Anne, which desire he states Leonardo, according to his custom, long put off with words, the real reason being probably that paralysis of the hand to which Antonio de Beatis refers. He speaks of the frequency of the King's visits to him, and is the author of the story of Leonardo having died in the King's arms, which is disproved by the fact that as records show on the day before his death the King was with the Court and signed a decree at St. Germain-en-Laye.

The relations which existed between Leonardo and the King are defined with somewhat more of circumstance by Benvenuto Cellini, who followed the former to France twenty-four years later, as one of the band of Italian artists who entered the service of the French Court, and gathered up some of the traditions that lingered there about his predecessor. He had been an eager student in his youth in Florence of the cartoons of Leonardo and Michelangelo for the works in the Signoria, and it was he who said of them in his Memoirs that for so long as they remained there they were 'the school of the world.' From the same vivacious narrative we learn that Leonardo's yearly salary while in France was seven hundred crowns, Cellini having been informed of this by the Cardinal of Ferrara, who told him at the same time that the King would give him the same amount, a previous offer by Francis of three hundred crowns having been rejected by Cellini in high dudgeon. In his treatise on architecture the latter states that he was the possessor of a copy of Leonardo's treatise on the three great arts of sculpture, painting and architecture, and then follows a naïve and graphic picture of Leonardo's life at the French Court, which reveals how, although the time of action was over, he had dominated it by virtue of his intellectual powers,

and how after the passing of over twenty years his memory had become an inspiration. 'Since his genius,' he says, 'was as varied as it was great, and since he had some knowledge both of Greek and Latin letters, King Francis being violently enamoured of his great talents took so great a pleasure in hearing him discourse that there were few days in the year when he was separated from him, and it was for this reason that he did not have the opportunity of putting into actual use the splendid studies which he had carried on with such devotion. I feel that I must not neglect to repeat the exact words which I heard from the King's own lips about him, which he told me in the presence of the Cardinal of Ferrara, the Cardinal of Lorraine, and the King of Navarre. He said that he did not believe that there had ever been another man born into the world who had known as much as Leonardo, and this not only in matters concerning Sculpture, Painting, and Architecture, but because he was a great Philosopher.'

With the challenge of this tribute, taken from the lips of the young impressionable monarch who had been constantly in Leonardo's company during the last years of his life and had learned something of the stored-up treasures of his mind, contemporary records end.

¶ PART TWO
THE MANUSCRIPTS

¶ PART TWO

THE MANUSCRIPTS

§ 1

It is almost impossible to make any attempt to estimate the original number or the bulk of Leonardo's manuscripts. Antonio de Beatis, the secretary of the Cardinal of Aragon, who visited him at Cloux, speaks of seeing there 'an infinite number of volumes all in the vulgar tongue.' Under the terms of Leonardo's will all his books were bequeathed to Francesco Melzi and by him they were taken back to Milan, and there they were seen forty-seven years later by Vasari, who comments on how difficult it would be to decipher them on account of their being written backwards, and expresses special admiration for those which treat of anatomy. Already apparently some of those which related to art had passed out of Melzi's possession as Vasari speaks of them as belonging to a Milanese painter, whose name he does not mention, but who, as he states, had visited him in Florence, and had taken these manuscripts with him to Rome with the intention of arranging for their publication, this being probably the first reference to the segregation of those portions of the manuscripts which formed the basis of the *Treatise on Painting*, of which an edition was published in Paris in 1651. Francesco Melzi, who, according to Vasari, guarded Leonardo's manuscripts with as much care as though they were relics, died four years after his visit to him. His heirs apparently did not value them as he did, and the process of dispersal soon began. After experiencing various vicissitudes, fourteen of the manuscripts passed into the Ambrosian Library in Milan by donation at various periods in the course of the seventeenth century. Two subsequently disappeared and one was added, and from this apparently safe anchorage the thirteen remaining were removed to France in 1796 by the order of Bonaparte, and when, on the conclusion of the Napoleonic wars, the return of art treasures was de-

manded by the Allies, the order was only complied with in the case of the Codice Atlantico, the other twelve of Leonardo's manuscripts being left in the Library of the Institut de France, where they now are. Others of the manuscripts originally possessed by Francesco Melzi have passed after unnumbered vicissitudes into the Royal Library at Windsor, the British Museum, the Science and Art Library at South Kensington, and Lord Leicester's Library at Holkham Hall. One of those originally given to the Ambrosiana is in the Library of Prince Trivulzio at Milan, and a part of another on the flight of birds has been given by its most recent possessor, Sabachnikoff, to the Royal Library at Turin. Others undoubtedly of those in Melzi's possession have been lost. Of the paragraphs contained in the compilation known as the *Treatise on Painting*, made from the manuscripts previous to their dispersal, which exists in its most complete form in a manuscript in the Vatican Library (Cod. Vat. Urbinas 1270), only about a quarter are identical with passages in the extant manuscripts. As, however, among this quarter are numbered almost all the most striking and impressive sections of the book, it may be conjectured that part of the remainder is made up of notes taken by a pupil. Some of the paragraphs, however, which bear the unmistakable impress of Leonardo are not in the extant manuscripts.

The largest of these, the Codice Atlantico, containing 1,222 pages, is a scrap-book formed by Pompeo Leoni: in compiling it he not only used scattered sheets but cut up manuscripts as suited his purpose. Who can say what he may have rejected or what may have fallen a victim to his scissors? As, however, the competition to obtain Leonardo manuscripts was keen, so the recognition of their value operated to save by far the greater part from destruction. They now number more than 5,000 pages. Being in the fullest sense of the words his notebooks, they admit us the more closely to the workings of his mind. As regards

his commissions, they show the infinite toil of the preparation of what seems in its perfection effortless. If the mischances of time should cause his few remaining works in art to perish, the manuscripts which the labours of scholars during the past fifty years have made available for study would yet serve as a great testament to show what he was and what he laboured to perform. A few are homogeneous. They are the record of his study of the various sciences which he looked upon as part of the artist's full equipment and which he pursued in all available authorities and, above all, by observation and experiment. So we find treatises and parts of treatises on optics and astronomy, on botany and geology, as well as on perspective and light and shade, and on equine and human anatomy. The larger section, however, treats of many subjects, notes on the same page being sometimes written, apparently, at a considerable interval of time. Leonardo being an omnivorous student, his notebooks contain much matter that is not original and which he was merely transcribing, and the identification of this has been a gradual process, and is certainly not yet completed. To take an example, we may consider some of the contents of Manuscript H, now in the Institut de France, which various time references show to have been written in part during 1493 and 1494, the former being the year in which the clay model of the Sforza statue was set up in Milan and both being years of Leonardo's close association with the court of Il Moro. The fact that a considerable number of pages at the beginning and end of this manuscript contain the rudiments of a Latin grammar written with more than usual legibility, both the Latin and the Italian forms occurring in some instances in the conjugations of the verbs, led Amoretti to surmise that they were written with a view to the instruction of Maximilian Sforza; but if this were indeed the case Leonardo was certainly more than a little previous because the son of Ludovic and Beatrice d'Este was not born until the twenty-fifth of January 1493,

and he would therefore be less than two years old when the latest dated entries fix the probable ultimate date of this manuscript as having been written. Some few pages of Latin conjugations are followed by a compact section of forty pages, in which the writing is practically free from erasures, consisting of stories and anecdotes about animals. Their origin is more easily defined than their purpose. Some are transcripts from Pliny slightly abbreviated in the process but in the identical order.

The subject matter of these is somewhat meticulous. They abound in geographical details and are fabulous to a degree. He follows Pliny in calling Scandinavia an island. In others the moralizing tendency is more pronounced and, as Calvi has shown, some of these were derived from the popular mediæval bestiary *Il Fioro di Virtù*, in which each of the various qualities of good and evil in man's nature were found located in a type of animal, and so each came to acquire a spiritual meaning, and some from the *Acerba* of Cecco d' Ascoli, astrologer, physician and poet, who suffered death by burning at the hands of the Inquisition for this and other products of his brain. The *Acerba* attempts in *terza rima* to expound all things in earth, air and heaven, and is a strange farrago of the fabulous and the bizarre, full of gnomes, salamanders and the like. All three – Pliny, *Il Fiore di Virtù* and *Acerba* – occur on the list of books written by Leonardo on a page in the Codice Atlantico, which it is conjectured formed his library. Why this compilation, in the making of which he seems somewhat in the position of a child playing with mediæval toys? Calvi's suggestion that he may have been intending to make *imprese* or heraldic devices seems rather overborne by their number. Did it just arise out of his own interest in the grotesque and the bizarre as representing inversion of the natural order, or may it possibly have been written for the purpose of instruction? One might suppose this from the passage in which, after describing the lion as covering over its tracks so that its route may not be known to its

enemies, he adds, 'even so a captain should conceal the secrets of his mind to prevent the enemy from knowing his plans'; also from the prominence given in examples to such cardinal virtues as humility, gentleness, and modesty; but the frankness of other passages is such as to controvert the supposition. On rare occasions he allows himself sufficient latitude to introduce a beautiful simile, so after a story of the lark's behaviour in the presence of a sick person he adds that 'the love of virtue shows itself more in adversity than in prosperity, like light which shines most brightly when the place where it is is darkest.'

How closely at times he followed his originals may be seen by the instance of the swan. Cecco d'Ascoli, in *l'Acerba* X, v. 1–3, says:

> 'El cigno è biancho senza alcuna machia
> e dolcemente canta nel morire
> non fina fin che morte noil' atachia.'

Leonardo, in Manuscript H, folio 13v., says: 'cignio e candido senza alcuna macchia e doicemente canta nel morere, il qual canto termina la uita.'

In more than one instance, as Calvi has pointed out, he has preferred the more fantastic descriptions which he found in *Il Fiore di Virtù* and *Acerba* to the more practical statements of Pliny. So while he has taken from Pliny's account of the tiger the statement how the hunter, after seizing her whelps and riding off on a swift horse, is tracked by the tiger by their scent and saves himself by throwing down first one and then another of the whelps, and so as the tiger stops to carry these back to her lair is able to reach his boat and escape, he takes from *Acerba* the idea of the mirrors which the hunter leaves in the place from whence he took the whelps, so causing the tiger on her return to imagine that she sees her young until by scratching with her paw she discovers the deceit. These stories or zoological notes number some ninety in all. Some few are of fabulous animals, but about them all there is a curi-

ous sense of unreality and remoteness. The thinker who in the Windsor Manuscripts is seen at work on the foundations of comparative anatomy and embryology is here delving into ancient and mediæval lore, not as a scientist but as a collector of fables.

When half of these have been told he intersperses a few maxims, terse, epigrammatic – touching life more nearly, e.g.:

'The memory of benefits teaches ingratitude; it is fragile.'
'Reprove a friend in secret, praise him before others.'
'Lie not about the past.'

The last injunction apparently had no terrors for the fabulist, for the beast stories begin again with that of the crocodile as an emblem of hypocrisy weeping for the man he has killed before starting to devour him. The weeping crocodile occurs in Mandeville, which is one of the list of volumes that Leonardo wrote on a page of the Codice Atlantico, and which may have formed part of his library. In the notes which follow the toad is likened to the enemy of virtue as puffing itself up as a shield from the rays of the light, the caterpillar appears as an emblem of virtue in general, in that by means of diligence and care it weaves round itself a new dwelling-place with marvellous artifice and subtle labour, and afterwards emerges from it with lovely painted wings with which it rises towards heaven, and he gives a touch of his descriptive power when he tells how at the sound of the lion roaring to awaken its young on the third day after their birth 'all the wild things which are in the wood flee away.'

While these notes do not rank as a product of Leonardo's imaginative faculty, their importance in the attempt to gauge personality is hardly lessened by the fact of their being derived from the text of Pliny decked out in new fantasy from early bestiaries and the *Acerba*. 'With our deeper and more logical sense of life,' says Stevenson, after telling in his essay on Charles of Orleans of a tapestried room where the

latter may have played in childhood, 'we can have no idea how large a space in the attention of mediæval men might be occupied by such figured hangings on the wall.' An age when the book associated with the name of Mandeville and others of a like character were read as the records of travellers, when the symbolism – whereof the bestiaries which found for every quality of good and evil in man's nature a type in the beast-world serve as an example – sculptured strange grotesque creatures on the churches, was full of associations the potency of which we cannot fully measure. Even as we see Leonardo toying with them, as though in disport, we see the deeper chords of his nature stirred into activity.

Perhaps some thought of the awful mockery of burning in the name of religion Cecco d'Ascoli, the author of the poor irrelevant fancies and fallacies which formed a part of his sources, may have prompted the feeling of pity and sympathy for all created things that suffer injustice which vitalizes all this section of the stories of animals and the Manuscript H in which they occur.

It is seen in the allegory drawn on folio 63[15]v., of a tired bird fluttering downwards and a man following it with dog and falcon, by the side of which he has written the words 'brief liberty.'

A note below runs, 'the goldfinch gives spurge to its caged little ones,' and then follows the comment, 'death rather than loss of liberty.' We discern something of that sympathy which, according to Vasari, led Leonardo to buy caged birds from their vendors in the street in order immediately to set them at liberty. We think of the testimony of that correspondent of Giuliano de' Medici, Andrea Corsali, who, writing a description to him of certain of the peoples of India, spoke of the tribe of the Gujerati as not using any living things as food, adding that 'like our Leonardo da Vinci they do not allow that anyone should do any injury to anything which has life.' On folio 89[41]v. of Manuscript H he says, 'we make our life by the death of others.' 'In dead mat-

ter,' he adds, 'there yet remains an appreciable life which when joined to the stomachs of the living resumes a life of the senses and the intellect.'

He felt himself faced with the need of framing an alternative in defence of his position, for on folio 60[12]r. of the same manuscript he attempts to state why plants when broken or injured do not suffer pain as do animals.

'Since nature has ordained that vegetable existences should suffer with movement in order to preserve the members which might be diminished or spoilt by movement, the vegetable existences without movement do not have to run against opposing objects; consequently suffering is not necessary in plants, and therefore if they are broken they do not feel pain as do those of the animals.'

On the first page of this same Manuscript H, above some Latin conjugations occur the words, 'dasserare acchiave vno incasstro avigievine' (da serrare a chiave uno incastro a Vigevano), which Richter translated, 'to lock up a butteris at Vigevano.' Incastro from incastrare, to embed, or let in, is primarily a recess or bevel, and in its first derived signification 'a tool for cutting a horse's hoof to receive the shoe' (Hoare), i.e. a butteris which is defined in Murray's Dictionary as a farrier's tool for paring a horse's hoof. Revaisson-Mollien, in his edition of the Paris Manuscripts, emends the translation somewhat conjecturally, thus 'pour former à clef un encastrement [barrage d'eau (une porte d'écluse?)] a Vigevano' (to close with a key a lock gate (?) at Vigevano). Murray's Dictionary, however, quotes two instances of the use of the word butteris: P. Beckford (Hunting, 1802), 'that destructive instrument called the butteris . . . should be banished for ever,' and Youatt (Horse, 1853), 'the formidable butteris is still found in the smithy of the country farrier, although it is banished from the practice of every respectable operator.' A consideration of these may perhaps induce the reflection whether possibly Richter was not correct in his

interpretation after all, and whether Leonardo was not here as so often a precursor of modern ideas, anxious to lessen the sum of the suffering of the brute creation, and so making a note to lock up and consequently to restrain the use of an instrument the complete banishment of which was urged by English writers on farriery in the last century by reason of its cruelty.

§ 2

'Cosa bella mortal passa e non d'arte.'

(Beauty in life perishes not in art.)

No saying attributed to Leonardo has attained a wider currency than this sentence as printed in Richter's edition of his works. It seems to sum up succinctly and with supreme felicity some of the thoughts expressed in that section of the treatise on painting in which Leonardo upholds the supremacy of painting among the arts. Another sentence in the notebook at the South Kensington Museum which contains this line defines the painter's work in a lucid phrase as being 'to strive and compete with nature.' At the moment, whatever excellence the painter may attain to, he can only know defeat in such a contest. Defeat more palpable since in proportion as his vision is clearer, there is still something in the mystery and beauty of life which must excel: some essence rich and unexplored which illudes while it mocks the aspirant. Leonardo himself is said to have confessed as much: he worked during four years at the portrait of Mona Lisa and yet after all, according to Vasari, he was constrained to leave it unfinished. There was something in her beauty that he saw which his art could not compass. To the one sentence in the South Kensington Manuscript the other might fitly serve as the correlative. Defeated for the time in his attempt to rival nature the future is yet to the artist, in that his is the work that endures, and not the bloom on the cheek he paints, the beauty and sinuous mystery of the hair, or the light

of the eye that meets his: all these shall perish ere the creation of his art. 'Cosa bella mortal passa e non d'arte': and D'Annunzio has given a far wider currency to the thought than any of Leonardo's editors by placing the sentence on the title page of his play *La Gioconda*. Yet facts are stubborn things and may ultimately prevail.

The line is not as it occurs in Leonardo's manuscript. The profound antithesis which it contains rests on nothing more substantial than the error of the transcriber. What Leonardo wrote was, as Mr. Eric Maclagan has pointed out (*Times Literary Supplement*, 8 March 1923), a quotation from Petrarch, 'cosa bella mortal passa e non dura' (beauty in life passes and does not endure), and with it he made a sketch of the head and shoulders of a very old woman, toothless, with sunken cheeks and deep hollows in the neck and all the emaciation of extreme age, which has an appropriateness that it would not possess if the line were as Richter gave it. Having followed Richter's reading of the text when translating the sentence in a volume of selections from the notebooks, I may plead in palliation of my error that the text of the passage has a more than usual degree of illegibility, and that the difference between the different readings lies only in the second and fourth letters of the last word *dura*, which, following Richter, I took to be *dart*, the final stroke of the last letter being apparently slightly truncated by the margin, and the strokes of the *u* coming rather close together.

The sketch of the old woman which accompanies the line in the South Kensington Manuscript may serve to recall the passage in the Codice Atlantico (folio 71r.a) in which Leonardo, with rare descriptive power as it appeared, uses the vision of the old age of Helen in order to illustrate the remorseless flight of time.

'O Time, thou that consumest all things! O envious age, thou destroyest all things and devourest all things with the hard teeth of the years, little by little, in slow death! Helen,

when she looked in her mirror and saw the withered wrinkles which old age had made in her face, wept, and wondered to herself why ever she had twice been carried away.

'O Time, thou that consumest all things! O envious age, whereby all things are consumed!'

But here, as Calvi has shown, Leonardo has been writing down a passage which he has read in Ovid's Metamorphoses. His creative genius has played upon it in the process, touching, amplifying, rounding it off, but the result is in essentials a translation of:

'Flet quoque, ut in speculo rugas aspexit aniles
Tyndaris, et secum, cur sit bis rapta, requirit.
Tempus edax rerum, tuque, invidiosa vetustas,
Omnia destruitis, vitiataque dentibus aevi
Paulatim lenta consumitis omnia morte.' (XV, 232–6.)

'Helen also weeps when she sees her aged wrinkles in the looking-glass, and tearfully asks herself why she should twice have been a lover's prey. O Time, thou great devourer, and thou, envious Age, together you destroy all things; and, slowly gnawing with your teeth, you finally consume all things in lingering death!' (Miller Loeb.)

As from this passage it would follow clearly that Leonardo was acquainted with part of the Metamorphoses, it may be that he knew also the passage in an earlier part of the same book (XV, 60–110) in which Ovid expounds the doctrines of Pythagoras in respect to the avoidance of animal food. The tenets which Andrea Corsali attributed to him in the letter in which he compared his practice with that of the Gujerati, and the spirit that animates such a passage as that in the Windsor Manuscripts (R 844) where Leonardo retorts to an imaginary antagonist, who has described man as king of the animals, that he shall rather be termed king of the beasts, being the greatest of these and having refrained from killing them in order that they may give up their children to

him to satisfy his capacious maw, of which he has attempted to make a sepulchre for all the animals, are identical with these which Ovid puts into the lips of Pythagoras:

'Heu quantam scelus est in viscera viscera condi
Congestoque avidum pinguescere corpore corpus
Alteriusque animantem animantis vivere leto!
Scilicet in tantis opibus, quas, optima matrum,
Terra parit, nil te nisi tristia mandere saevo
Vulnera dente juvat ritusque referre Cyclopum, –
Nec, nisi perdideris alium, placare voracis
Et male morati poteris jejunia ventris!'

'Oh, how criminal it is for flesh to be stored away in flesh, for one greedy body to grow fat with food gained from another, for one live creature to go on living through the destruction of another living thing! And so in the midst of the wealth of food which Earth, the best of mothers, has produced, it is your pleasure to chew the piteous flesh of slaughtered animals with your savage teeth, and thus to repeat the Cyclops' horrid manners! And you cannot, without destroying other life, appease the cravings of your greedy and insatiable maw!'

Calvi considers that Leonardo's lines in Manuscript B (folio 3v.) that rumour (fama) should be painted with all its body covered with tongues instead of feathers, in the form of a bird, are derived from the representation of rumour (fama) in Book IV of the Aeneid, where she is depicted as flying through the cities of Libya 'swift of foot and fleet of wing,' a monster awful and huge, who for the many feathers in her body has as many watchful eyes below – wondrous to tell – as many tongues, as many sounding mouths, as many pricked-up ears.' The resemblance seems, however, hardly sufficient to afford proof of derivation. Whereas in Leonardo's conception the figure of rumour is covered with protruding tongues instead of feathers, in the more elaborate

description given by Virgil there are not only tongues, but eyes, mouths, and ears.

That Horace was among the authors whom Leonardo studied is shown by the fact that in a passage in Manuscript G, folio 8v. entitled, 'of the error of those who practise without knowledge,' in which he compares those in love with practice without knowledge to a sailor who enters into a ship without having either rudder or compass and who therefore can never be certain where he is going, a note occurs in the margin, 'vedi prima la poetica d'Oratio,' the reference of course being to the Ars Poetica, of the ruling principles of which Leonardo's next sentence, 'practice must always be founded on sound theory,' might fitly serve as an epitome. A line on the cover of Manuscript F of the Institut speaks of Horace as having written on the velocity of the heavens, but it has not been found possible to say what passage in Horace's works, if any, Leonardo had in mind. There is possibly yet another reference in a sentence which occurs in the manuscripts at Windsor which deal with anatomy:

'Oratio.
Tu o Iddio ci vendi tutti li beni per prezzo di fatica.'

which Richter interprets as:

'A Prayer.
Thou, O God, dost sell us all good things at the price of labour.'

The similarity which exists, however, between this sentence and a line in the Satires of Horace:

'Nil sine magno
Vita labore dedit mortalibus.' (Sat. I, 9, 58–9.)

lends some support to the suggestion that the passage should be considered as a reference to Horace, rather than as a prayer as Richter suggests – the word 'Oratio' covering either

interpretation – and that Leonardo has borrowed and enriched the Roman poet's thought.

§ 3

As the foregoing instances serve to illustrate, there are certain obvious difficulties in the attempt to define Leonardo's personality by reference to his manuscripts. The notes therein have been taken from many sources, and the process of identification has been gradual and may continue. The very stones which seem fittest to be the heads of the corner may yet be rejected on the strength of fresh evidence of origin. It is, however, from the manuscripts that the myriad-mindedness of Leonardo is most fully apparent, and as offering the proofs and the records of this intellectual activity they present the truest picture of his personality. If it were possible to study a portion of that vast scrap-book known as the Codice Atlantico, made by Pompeo Leoni with scissors and paste from various manuscripts without any preliminary knowledge as to its authorship, the pervading consciousness in the mind of the student would be that the sheets were the work of a scientist and mathematician, whose dominant purpose was the recording of phenomena and the results of mathematical calculations and the practical application of these in problems of construction.

Against this continuing background he would see the sporadic witness of the activities of a mind charged with high ethical purpose, and that insatiable curiosity after knowledge which finds expression in minute observation of the laws of structure of all created things, a mind alive to every perception of beauty, stoical in resignation under adversity, and full of sympathy and consideration for everything that has life. His work in science, whether in mathematics, mechanics, optics, astronomy, anatomy, geology or botany, to name some of the divisions into which it falls, is of such a character that only the specialist can attempt to estimate its exact value, and as the specialist must needs now be content to follow one or

two furrows any such attempt must touch only a section of his labours. The transliteration and photographic reproduction of the greater part of his manuscripts have prepared the way for this more exact knowledge, and yet for the most part they lie fallow. It is where they touch the humanities that their appeal is more potent. The minute observation in certain of his drawings of the laws of structure of the vegetable and animal kingdoms seems to reveal both the artist's absorption in pure form and the scientist's interest in the laws which control it. Such juxtaposition may be accidental, yet is hardly less significant. On a page of the Codice Atlantico (folio 156r.b) filled with mathematical drawings of the sections of circles, cubist in general effect, we find a sketch the length of a thumb-nail of Leda, vivid, spontaneous in its freedom of line and pose, which serves to prove that the various large compositions of the subject in the Villa Borghese, at Hanover and elsewhere are in debt for their origin to a sketch by Leonardo. In the Codice Atlantico and the Windsor Manuscripts are many studies, sketches, plans and calculations which go far to establish the testimony of Sabba da Castiglione as to his having spent sixteen years on the preparation of the Sforza statue.

The characters of the various actors in the great drama of the Last Supper live for us in a descriptive note in the Forster Manuscript at South Kensington (fol. ii. 62v. and 63r.). The Codice Atlantico contains the narrative from which he derived the incidents depicted in the cartoon for 'the Battle of Anghiari.' In the passage on 'the way to represent a battle' in the Paris Manuscript (2038 Bib. Nat. 31r. and 30v.) he seeks to build up the effect by infinite accretion of detail. Smoke, dust, oozing blood, agonized faces and limbs of combatants all acquire a functional significance, building up tersely, relentlessly, the horror of the action.

The undulating movement of water is constantly used by Leonardo as a symbol of the rhythmic harmony of nature. Here he would show a river, within which horses are gallop-

ing, 'stirring the water all around with a heaving mass of waves and foam and broken water.' 'Bestialissima pazzia,' 'frenzy most bestial,' so he styled combat, and so he portrayed it with his pen and his brush. It is perhaps with some feeling of surprise that we find the mind of the thinker who proclaimed this truth busying itself with the task of devising and perfecting instruments of warfare. Leonardo has, however, written his own justification, and it is that which should constrain every man to take up arms when need arises. It is, he says, only by force that freedom can be maintained against those who seek to destroy it: it is as a means to this end that he feels it to be necessary to study engines of warfare, and to devise new and more effective combinations of force for warfare on land or by sea; by virtue of which he ranks as one of the great anticipators of modern instruments of warfare.

Two sentences in a passage in the Windsor Manuscripts may serve in succinct phrase to suggest the two divisions into which fall much of his research and speculative thought. After describing the faculty of the imagination as rudder and bridle of the senses because the thing imagined moves the sense, he adds, 'pre-imagining is the imagining of things that are to be, post-imagining is the imagining of things that are past.' Under the one rubric falls the consideration of diving apparatus and submarine boats and methods of sub-aqueous attack, the use of poison gas in warfare, the researches into the laws which govern the construction of aeroplanes, and the principle of the tank or armoured car, as well as a host of things which minister to intellectual and practical needs, among which may be mentioned the telescope, 'fa occhiali da vedere la luna grande,' wireless telegraphy, steam-driven vehicles, and many hydraulic instruments and cutting and perforating tools. Under the other lie the sum of his researches in the natural history of the earth, the changes in its surface due to the hand of time. 'Do you not see,' he says, 'in the high mountains the walls of the ancient and destroyed cities covered over and concealed by the increase of the

earth?' (C.A. 265r.a.) All his studies in geology show him that 'the wide plains which are between the sea and the mountains have all been covered by the salt waters.' (C.A. 326v.b.) In tracing out the effect of this in the countries which border on the Mediterranean he shows himself a master of language in such power of selection as serves to heighten the imaginative effect which the picture naturally creates. 'The gulf of the Mediterranean as an inland sea received the principal waters of Africa, Asia and Europe that flowed towards it; and its waters came up to the foot of the mountains that surrounded it and made its shores; and the summits of the Apennines stood up in this sea like islands, surrounded by salt water; . . . and above the plains of Italy, where now birds fly in flocks, fish were wont to wander in large shoals.' (Leicester MS. fol. 10b.) In another passage in the same manuscript (fol. 31a) he shows how the basis of study has been constricted by time and what field remains to the student, 'since things are far more ancient than letters, it is not to be wondered at if in our days there exists no record of how the aforesaid seas extended over so many countries; and if moreover such record ever existed, the wars, the conflagrations, the deluges of the waters, the changes in speech and habits have destroyed every vestige of the past. But sufficient for us is the testimony of things produced in the salt waters and now found again in the high mountains far from the seas.' So he studied the shells in clay-deposits and the bones of fishes found petrified in the rocks.

On the same page of the Codice Atlantico on which he speaks of seeing among the mountains the walls of ancient cities covered by the earth's increase, with reference probably to some ruins of the Etruscan period, two sentences occur which form part of the description of the huge prehistoric fish the skeleton of which he found in a cavern of the hills, and which he spoke of as lying within its narrow space destroyed by time, forming with its bones despoiled and bare an armour and support to the mountain above it. (B.M. Arun-

del 263, folio 156r.) Thus busied in pre- and post-imagining, speculating as to what lay hidden in the womb of the future and searching into what the testimony of the rocks could reveal, his spirit – pilgrim to the present – moved serenely in the worlds of which he had vision. The records, even the vision itself, may seem and are inchoate, fragmentary, intangible, but how uncharted the seas on which he fared!

Our past it is clean forgot,
Our present is and is not,
Our future's a sealed seed-plot,
And what betwixt them are we?

Roger Bacon had just such prescience, foretelling almost all that Leonardo did of what lay hidden in the future, though more with the language of prophecy than of science. But unlike Bacon, so far as record holds, he travelled along the pathway of experiment in the case of the greater number of the inventions which he foretold.

§ 4

The frequency with which calculations and diagrams connected with mathematics and science occur in the manuscripts would of itself suffice to controvert the estimate of personality which the early biographers sought to establish. They assumed an almost apologetic vein in referring to studies which are seen to have been an inherent and dominating quality of his mind. Cradled in the intellectual world of Florence of the Quattrocento it moved from the sphere of art to that of science gradually, almost imperceptibly, in a manner somewhat typical of that Renaissance of which he was the supreme type. But a nature as richly endowed as was Leonardo's was receptive to all the intellectual interests of his time. In a passage in which he defines the ideal life for the painter in his studio he wrote, 'se tu sarai solo tu sarai tutto tuo,' 'if you are alone you belong entirely to yourself,'

but in that same solitude he reveals so wide an interest in and sympathy with all forms of human activity as serves to recall the words of the Terentian adage, 'et nihil humanum alienum a me puto.' The really outstanding feature of the manuscripts is the myriad-mindedness which they reveal. We may get a vista of it by attempting to summarize a small section of the Codice Atlantico.

Within the compass of the pages numbered from 251 to 300 we find that in addition to mathematical calculations and diagrams without number the text contains: fables, geometrical puzzles, domestic accounts, a note to inquire about tides on the Black Sea and the Caspian, a comparison of the movement of tides with that of the passage of air in the lungs, a note as to the distance of the sun from the earth, another as to the cause of condensation or rarefaction of smoke and flame; studies in optics, notes of the increase in the size of the pupil in the eye of the owl, of man and of the cat and of the nocturnal habits of the owl, on the evaporation of the water in the Mediterranean, and a series of examples of how the earth's surface is increased by processes of vegetation; lines that form part of a description of a prehistoric sea monster; studies in mensuration, in the trajectory of a cannon, in the raising of tree trunks and beams without the use of cords; the law of motion of flame, the nature of hail; a draft of a letter to the Commissioners of a Cathedral pointing out what principles should be followed and what avoided in the construction and repair of the fabric; an explanation of the nature of the flame of a candle; a prescription for a medicine to be taken in order to break a stone in the bladder; an argument and instances of the power of vision to project itself, some of these being derived from the founts of mythology; studies in the problem of squaring a circle; a description of a large pleasure garden; drawings of interlacing branches, being studies apparently for the decoration of the ceiling of the Sala delle Asse in the Castle of Milan; numerous drawings of flowers, leaves, heads and busts of women; receipts

for mixing colours; considerations on the law of gravitation, which seem an anticipation of Newton's theory; studies in mechanics; sketch map of the Lake of Lecco and the district to the north, made apparently in preparation for a canal; notes and sketches of the points of the wings of a flying machine; sketch with notes of a man swimming with an inflated leathern jacket; study for model of flying machine with discussion of the most suitable position for the occupant; architectural study of section of moulding; study of angle of incidence and law of refraction; money sums; law of complex shadow; a personal note wrung from him as it were by necessity, 'though the marble suffer ten years I am not willing to wait for my payment after the conclusion of my work'; a drawing of a dart; sixteen titles of sections of treatise on light and shade; conparison of sculpture and painting; a passage treating of optics; notes and sketches of cog wheels, catapult (balestra), wind shuttle with note, 'if the instrument is made in this way you will have perpetual motion'; sketch of mechanism for moving two wings; study of law of equilibrium illustrated by sketches of birds in the act of falling; account of vaporization produced by fire or other heat in damp air; proof that the movement of wind in the atmosphere is in a straight line and not circular as Aristotle says; statement about the nature of tides, which he attributes to rivers, ignoring the influence of the sun and moon; elaborate studies of knots and interlacing patterns; sketch of mill at Vinci; studies in mechanics; letter to a patron, presumably Giuliano de' Medici, congratulating him on his restoration to health, and giving a circumstantial account of the misdeeds of a German apprentice who lived with him; household accounts; detailed description of a temple of vast dimensions; drawing of recumbent female figure; note as to the Pope's private chamberlain having one of his books; note as to the nature of water, as to the relative dimensions of cube and pyramid; note of the 'labours of Hercules for Pier F. Ginori,' and beneath it 'the garden of the Medici,' the

reference being presumably to a commission in sculpture, there undertaken, or perhaps only contemplated; studies for the canalization of the Arno; consideration of the nature of vacuum and nothingness; a page of moral sayings, the second of which is obscure – they are: Aristotle in the third of the Ethics: man is worthy of praise or blame solely in respect of those things which are in his power to do or not to do; your words freeze in your mouth and you will make ice in Mongibello (Etna); just as iron rusts with disuse and water putrifies or freezes in cold so the intellect is wasted without use; you do ill if you praise, but worse if you censure, what you do not rightly understand; when fortune comes seize her with a firm hand – in front, I charge you, for behind she is bald; – the measurements of the Sicilian horse, which he studied probably for the Sforza statue; a drawing of a royal throne; a statement of how the drops of moisture are formed in the air; a drawing of hydraulic machinery; note of 'the chained books'; a receipt for making scent; hydraulic studies of pressure of water in fountains, with a note that Amboise has a royal fountain without water; a consideration of the way in which air moves in a trumpet, of how damp air in caverns produces water, and of the principle of the whirlpool; a geometrical theorem showing how a line may be divided into three equal parts; a note of how in walking the right foot and the left arm move forward simultaneously; how bulls in feeding uproot plants; notes as to the necessity of appointing an official to constrain the inhabitants of the land bordering on rivers to see to their maintenance; drawing of girl in exact profile; study, presumably for a picture of St. Sebastian, the figure being seen fastened to the trunk of a tree; a note about the properties of the moon as being the mirror of the earth.

This tentative but meagre list of contents, in which research, art, fantasy and fact appear mingled inextricably, covers only an eighth of the encyclopædic Codice Atlantico. Two deserve a somewhat fuller mention as relating to a

section of his activity which only finds record in the manuscripts. The first on folio 271v.a reveals him as a landscape architect. His purpose is to lay out a large garden. The locality is not stated, but from the decorative use intended to be made of flowing water it is natural to suppose that it was either at Vigevano or somewhere else in the Lomellina, as other notes and drawings for making water descend in cascades are connected with this locality. The garden is to be laid out on sloping ground. He gives the exact dimensions of the curving steps which traverse it. There are to be fountains where in summer fresh water shall keep the air pure, fans to produce wind, and small channels of water to moisten the roots of orange trees and citrons. In the basins of the fountains the water grasses are to be kept cut so that the clear depths may be seen, and there are only to be such cresses there as shall serve the fish as food. The fish there are to be only such kinds as will not foul the water, that is there must be no eels or tench, nor pike as these destroy the other fish.

A fine network of branches is to cover the garden and shut in beneath itself many different kinds of birds, and so maintain perpetual harmony mingled with the scents of the flowers of the citrons and the lemons. With the fan there will also be sounds created from certain wind instruments which will make music as long as the fan is in movement. There is a curious air of unreality and inconsequence about this description. It begins prosaically enough with exact measurements and then, as so often happens in the manuscripts, the mood suddenly changes and the concluding passage seems spun of the fabric of dream. Yet a phrase in the most fantastic part of the description of this *hortus inclusus*, in which he tells how it should be covered over with a fine network of branches 'una sottilissima rete di rame,' might well serve as a description of the decoration of the arching roof of the Sala delle Asse in the Castle of Milan, which was made after Leonardo's designs. We may see in the course of the

description the practical designer giving place to the literary artist, and there is no evidence to show that the project was executed.

The description of a temple on folio 285r.c raises a question to which as yet no solution has been found. It is precise and circumstantial. 'Twelve flights of steps,' he says, 'led up to the great temple, which was of a circumference of eight hundred braccia (i.e. of more than twelve hundred feet) and built on an octagonal plan. At the eight corners there were eight large plinths, a braccia and a half in height, and three wide and six long at the base, with an angle in the middle, and upon these were eight great pillars twenty-four braccia high. On these were the capitals and above the architrave frieze and cornice carried in a straight line from pillar to pillar and so continuing for eight hundred braccia, surrounding the whole temple, ten large columns of the same height as the pillars, three braccia thick above their bases, which were a braccia and a half high, being placed between them as a support to this entablature.'

The second half of the passage is largely a repetition of the above, all the dimensions being given with the same exactness, but mention is made of pillars and columns within the temple corresponding to those without, and of the same height, over which 'the continuous architrave returns above the aforesaid pillars and columns.'

Can this description refer to any temple which he had seen? If so, where and on what occasion? Or are we to assume that despite the exactness of the dimensions twice stated the whole passage is merely an exercise of the constructive imagination testifying to Leonardo's interest in architecture of the grandiose type and to nothing else? Richter supposes the description to refer to some ruin, and rejecting the possibility of it being a reference to any temple in Italy or Greece on account of its enormous dimensions, suggests that Syria, the native land of colossal octagonal buildings in the early centuries, may contain this. But even if Leonardo's Eastern

journey were an admitted fact, in the absence of any attempt at identification of a building so colossal it would hardly seem possible to regard the passage as having reference to anything with a local habitation and a name.

The same love for the vast and the awe-inspiring is seen in the drawing in the Vallardi Collection in the Louvre, in which, amid a hilly landscape, Leonardo has represented an artificial mountain rising up in the form of a huge cone at the summit of which is a circular temple.

Rather more than half-way up the cone is a terrace in which are six doorways opening into galleries. These, as is shown in a plan below, lead each to three square chambers, intended apparently for the reception of sepulchral urns. Steps ascend the cone from two opposite sides as far as the terrace and on to the temple above, which has a circular opening in the dome somewhat reminiscent of the Pantheon. The whole scheme is characterized by Richter as one of the most magnificent in the history of architecture. He mentions certain analogies which exist between this design and various Etruscan sepulchral monuments and also some in Algiers. There is also some slight analogy between this plan and that of a certain class of monuments, probably sepulchral in use, numerous in Sardinia, styled noraghe or nuraghe, consisting of 'circular or elliptical structures of the form of a truncated cone, to which access is given by a door situated to the south-east, opening on a corridor which communicates with two ranges of chambers before reaching the central tower.' Multiply the numbers of door and corridors and we have the essential characteristics of Leonardo's ground plan of the interior of the cone. If there were any record of Leonardo having visited Sardinia it would not be altogether fantastic to suppose that the spectacle of one of these monuments may have given him the original idea of his vaster project. At the top of a page in the Codice Atlantico (folio 77r.b) are the words 'in Sardigna all' Antenoro,' and immediately below it a small drawing which represents the con-

fluence of two rivers. The note and the drawing have ostensibly the appearance of being a record of travel. The accompanying text contains a lengthy description of the meeting of two watercourses and how the line of the resultant varies according to their relative strength. The passage does not, however, increase any presumption of travel which might attach to the note at the top of the page, but seems to be merely such deduction of physical laws as Leonardo has made with reference to many places which there is no record of his ever having visited.

§ 5

So as it seems the manuscripts continually open out fresh avenues of conjecture. Some possible geographical or historical allusion serves the zeal of the biographer as a clue, and as suddenly the chord snaps, the rift closes, the mists descend, and what seemed for a moment a vista faint yet despite its faintness clearly defined becomes blurred and enigmatic. With the topographical notes especially it is hard to define sources of knowledge, and to decide how much should be interpreted as a record of experience unless propinquity come to our aid. Such as have to do with scenes near Milan such as Lake Como, Chiavenna, Valtellina and Bormio by their wealth of personal touches, e.g. the steepness of the mountains, the goodness of the inns, the cheapness of the cost of living and the prices of provisions, seem to betoken time spent in visits to hills and Alpine valleys of which the biographers have told us nothing. Where, however, the notes have reference to countries oversea vistas are more elusive and conclusions must needs be more tentative. At times it would seem that Leonardo himself deliberately adds to the difficulties of interpretation. All the charges of mystification which have ever been levelled against him by his biographers find their justification in such a passage as that on folio 247r.a of the Codice Atlantico, in which some proper names and certain other words are written with the

order of the letters inverted. 'Find *Ingil* (Ligny?),' it runs, 'and tell him that you will await him *a morra* (at Rome), and that you will go with him *in lo panna* (a Napoli) (to Naples). Make him pay *la e no igano dal* (la donagione) (the donation), and take the book by Vitolone and the measurements of the public buildings.'

There follow entirely practical details as to necessaries to be taken on a journey: two boxes covered with bedspreads to be borne on mules, a third to be left at Vinci – handkerchiefs and towels to be bought, also hats, shoes, four pairs of hose, a rough coat of chamois and hides to make new ones – a lathe – and what could not be taken was to be sold. Then various memoranda – for the most part of things connected with his activities as an artist, e.g. the method of painting in tempera to be learnt from Jean de Paris, to learn how to make white salt and tinted paper, to take his box of colours, and to learn how to work flesh tints in tempera, and how to make varnish from gum. To take certain books – *De Ponderibus* and the works of Leonardo of Cremona. To remove a cooking-stove belonging to Giovanni. To take seed of lilies, seaweed and gourds. To sell the boarding of the scaffolding. To learn levelling – how much soil a man can dig out in a day.

A few phrases are unintelligible, and the meaning of the whole passage would tax the powers of Œdipus. From the opening sentences Richter conjectures that at the time when Leonardo wrote the passage he was meditating a secret journey to Naples. But why the somewhat obvious mystification about the names? All the arrangements as to what luggage should be taken and what left, about choice of clothes and sale of superfluous effects, clearly point to the intention to undertake a journey, and Naples is named as the objective, but unless the idea crossed his mind during the period of the French occupation of Naples, when such opportunities as those here referred to might be thought to exist there, it is difficult to see any connection between the notes of travel

with which the passage opens and the memoranda of artistic matters which conclude it. As, however, Jean de Paris or Jean Perreal was Court painter to Louis XII and Francis I as well as to Charles VIII, and visited Milan in 1499 on the occasion of the entry of Louis XII, at which time Leonardo was still there, it may have been that this was the occasion on which he looked to acquire the knowledge of which he speaks. If this could be regarded as fixing approximately the date at which the whole passage was written it would follow that the projected secret journey to Naples was abandoned when Leonardo left Milan in company with Fra Luca Pacioli and travelled to Mantua and then to Venice.

The note of mystification with which the passage opens has many counterparts. We find it in the rebuses in the manuscripts at Windsor, where his spirit plays sportively, expressing sentences cryptically by means of pictures with a *naïveté* like that of the old monks who initiated the practice.

The sheets which contain them, reproduced by Rouveyre in *Croquis et dessins de Devises et Rébus*, have been studied in detail by Baratta in a section of his Curiosità Vinciane. The clearness of his interpretations almost veils the ingenuity and elaboration of some of the originals, but the most simple instances give the clearest idea of Leonardo's method. A drawing of two bears followed by the letters *e no* stands for *or si e no*; a drawing of a group of serpents interposed between the letters *e* and *to* stands for *e-sserpenti-to*; a drawing of a lark (allodola) preceded by *pri* and followed by *virtù* for *pria lodo la virtù*. Despite the ingenuity displayed the composite effect is somewhat disconcerting, as though one were taken to see an elephant and found it laboriously engaged in picking up peas. Had he lived in our times he might by analogy have explored the possibilities of cross-word puzzles.

Something of the same love of mystification, heightened in this instance by the mood of the seer, is found in the section of his writings styled 'the prophecies,' in which, following

strangely constituted divisions into things that relate to animals, irrational creatures, plants, ceremonies, manners, disputes and paradoxes, he sets himself to show 'first the evils and then the punishments of philosophical things.' In some of those which treat of ecclesiastical abuses and others such as those 'of metals' – with avarice for its theme, – 'of dowries for maidens' – which seems a portent of the ultimate extinction of the human race, – 'of the cruelty of man' – 'an animal always warring against his own species, persecuting, harassing and devastating all things that are on the earth or beneath it or in the waters' – his indignation rings out clearly and bursts through the trammels which the antithetical form of the sentence creates. Many are couched in the form of conundrums to which the title supplies the answer, for the most part of little import, but even in these we hear the accents of the voice that never failed of sympathy for anything living which suffered.

'And many others,' he says, after a sentence about ants, 'will be deprived of their store and their food, and will be cruelly submerged and drowned by folks devoid of reason. Oh, Justice of God! Why dost thou not wake and behold thy creatures thus ill used?' And the title is 'Of Bees,' which in the time when Leonardo wrote were destroyed in the process of taking their honey.

The note of mystification reaches its crescendo in the allegories where the descriptive notes complete and interpret the strange conceptions of his hand with such entire accord as to heighten their imaginative effect. The contrasts they embody are universal, but their accustomed setting is the Court of the Sforzas. The presence of Ludovic himself in the scenario is attested by a note in Manuscript I of the Institut, folio 138[90]v.

'For an allegorical representation.

'Il Moro, as the figure of Fortune with hair and robes and with hands held in front, and Messer Gualtieri with act of

obeisance plucks him by the robes from below as he presents himself before him.

'Also Poverty as a hideous figure running behind a youth, whom Il Moro covers with the skirt of his robe while he threatens the monster with his gilded sceptre.'

Messer Gualtieri's name occurs in Bellincioni's Sonnets as that of a patron.

Whether the youth sheltered by Il Moro be identified with Gian Galeazzo, as has been suggested, or no, the conception must be dated within a narrow space of years, for only in these could Il Moro appear as a figure of Fortune or threaten with a gilded sceptre. It may, as Richter suggests, be the subject of a somewhat indistinct sketch at Windsor (R. Plate LVIII). In the two great allegories which are among the sheets in the Library of Christ Church, Oxford, Leonardo moves augustly in a visioned world which alters not no matter who rules in Milan.

In one a drawing represents a figure single as to the trunk, but with two heads and two pairs of shoulders, one of a youth, the other of an old man, turned away from each other, the first holding a reed in his right hand and scattering gold from his left, the second holding a branch of laurel in his left and dropping from his right calthrops which were used in warfare to impede the progress of the enemy's cavalry. Leonardo describes the allegorical figure in a note as 'pleasure together with pain.' 'They are to be represented as twins because the one is never separated from the other. They are made with their backs turned to each other because they are contrary the one to the other. They are made growing out of the same trunk because they have one and the same foundation; for the foundation of pleasure is labour with pain, and the foundations of pain are vain and lascivious pleasures.'

The warning of the moralist is more piercing in the words which occur immediately beneath the figure from the out-

stretched hands of which, on either side, calthrops (triboli) and pieces of gold are falling: 'if you shall choose pleasure, know that he has behind him one who will deal out to you tribulation and repentance.' A macabre fantasy on a lower part of the same page represents Death the skeleton striding with his sickle behind two men who are riding upon a huge toad, the hindmost holding whip and bridle, the front one discharging an arrow from a bow, and beneath are the words 'evil thinking is either envy or ingratitude.'

On the reverse of the same sheet a drawing shows Death the skeleton as a steed ambling with huge spider-like legs, having two long bundles of arrows placed like panniers, astride of which a woman with pendulous breasts is sitting and raising one hand, while with the other she is holding a vase. Leonardo has himself interpreted what would otherwise be an enigma, yet his words fail fully to render the sense of mystery and plenitude of power that live in the flame-like lines of the drawing: 'This envy is represented making a contemptuous motion towards heaven, because if she could she would use her strength against God. She is made with a mask upon her face of fair seeming. She is made wounded in the sight by palm and olive. She is made wounded in the ear by laurel and myrtle to signify that victory and truth offend her. She is made with many lightnings issuing forth from her to denote her evil speaking. She is made lean and wizened because she is ever wasting in perpetual desire. She is made with a fiery serpent gnawing at her heart. She is given a quiver with tongues for arrows because with the tongue she often offends, and she is made with a leopard's skin, since the leopard from envy slays the lion by guile. She is given a vase in her hand full of flowers, filled beneath with scorpions and toads and other venomous things. She is made riding upon death, because envy, never dying, has lordship over him; and death is made with a bridle in his mouth and laden with various weapons, since these are all the instruments of death.'

At the right a slighter drawing of two bodies twined as though proceeding from a single trunk represents the contest of virtue and envy. From the accompanying comment we are led to judge that he deemed it eternal. 'In the moment when virtue is born she gives birth to envy against herself, and a body shall sooner exist without a shadow than virtue without envy.'

These allegories have also a personal significance. Some serve to express that fortitude and detachment of mind which bore vicissitudes unflinchingly and sought in the life of the student solace for the narrowing of the political horizon. Others are of value to the biographer in that they link him unexpectedly with people and events. The account of an elaborate allegorical representation (B.M. Arundel 263) (Richter 574), intended perhaps as a decoration for armour, with a richly decorated peacock in the half-globe above the helmet and on the shield a mirror and figures of fortitude and other virtues, has below it, 'Messer Antonio Gri (Grimani) the Venetian, companion of Antonio Maria,' the reference being to that Antonio Grimani, afterwards Doge, who in 1499 was in command of the Venetian fleet when it was routed by the Turks at Sapienza and was subsequently placed in confinement in Dalmatia. If the name be connected with the scheme for the allegory, and the juxtaposition certainly suggests this conclusion it was presumably made before Sapienza while Grimani still held the office of Captain-General and Leonardo was still at Milan, although it is believed that at this time his patron, Il Moro, was instigating the Turks to attack Venice.

He mentions in the Codice Atlantico (218r.a) a boast of the Venetians of having been able to spend 36 millions of gold in ten years in their war, this being at the rate of 300,000 ducats per month, the reference being to the association of Powers who formed the League of Cambrai against Venice in the year 1508.

By contrast with these references to Venetian affairs the

paucity of references to the affairs of Florence is somewhat significant. Perhaps his own natal circumstances tended to produce some hostility. The line about the Medici having created and destroyed him, coupled with the fact of the absence of any really important commission, are evidence of a certain antagonism. A slight drawing on folio 231v.a of the Codice Atlantico in which a bird with outstretched wings is represented drawn along on a cord, beneath which are the words 'bird of the comedy,' may refer to some scenic representation for the Court at Milan or elsewhere, but the similarity of the motive with the incident known as 'lo Scoppio del Carro,' which still takes place every year in Florence on the Saturday before Easter, when a wagon laden with fireworks is driven to the front of the Cathedral, and its contents ignited by a rocket in the form of a dove which descends along a string from the high altar, may prompt the supposition that Leonardo's note may have been made as an ironic comment on the proceedings, the progress of the dove being watched from the piazza by crowds of country folk who infer from it the nature of the forthcoming harvest.

Sometimes the juxtaposition of two notes reveals the thought transference as one theme suggests or develops into another. Or a note may thereby acquire a personal significance hardly otherwise apparent. So on folio 216v.a of the Codice Atlantico is a sketch in red chalk of a horse in a frame, with the words 'all the heads of the large nails.' It was made in preparation for the erection of the model of the statue in Milan on the occasion of the marriage of Bianca Maria Sforza, and the nails are projecting in order to show the distance between the frame and the statue. On folio 216v.b of the same manuscript occur the words 'tell me if ever, tell me if ever there was built in Rome anything . . .' The very pause seems eloquent. May we interpret the sentence as having reference to the statue drawn on another section of the page, and see in it a momentary mood of

exultation in which the artist, conscious as he must have been of the greatness of his work, full of the joy of creation, with the difficulties of conception ending with the completion of the model, challenges comparison for it in his thought with the masterpieces of antiquity?

§ 6

To correlate the degree of exactitude of his 'pre-imaginings' with the results of later research in the realms of thought in which he travelled alone would need the association of many minds trained in the pursuit of knowledge. Ever as the human spirit enters into fresh inheritances the greatness of Leonardo as a forerunner, great in observation, prophecy and achievement becomes more apparent.

Before Copernicus or Galileo, before Bacon, Newton or Harvey, he uttered fundamental truths the discovery of which is associated with their names. 'The sun does not move.' 'Without experience there can be no certainty.' 'A weight seeks to fall to the centre of the earth by the most direct way.' 'The blood which returns when the heart opens again is not the same as that which closes the valve.' This is not the language of the seer, but of the observer. Other instances there are, only less well defined than these. 'Fa ochiali da vedere la luna grande' (construct glasses to see the moon magnified) is almost certainly a direct anticipation of the telescope. No less certain is it his right to be considered as the forerunner of James Watt in the discovery of the propulsive effect of steam. While directly anticipating him in discerning the motive power which it possessed he failed to see the possibility of applying the discovery to purposes of locomotion and only referred to the power to project a missile from a cannon as the result of steam. 'The architronito,' he says in Manuscript B, folio 33r., 'is a machine of fine copper, the invention of Archimedes, which throws iron balls with much violence and fury. It is used thus: the third part of the instrument is filled up with a large charcoal fire: when

this is well lit you tighten the screw D which is above a vessel *a b c* and as you tighten the screw above the vessel the water will discharge itself below, and as it falls it will descend into the heated portion of the instrument, and will instantly be transformed into steam, of which the force and din will be marvellous to see and hear. This instrument will throw a ball weighing a talent a distance of six stadia.'

The basic principle of the use of steam as a motive power is identical with those of Watt and Stephenson which led to the discovery of the steam engine. It is, however, curious that Leonardo had apparently no conception of the uses to which the discovery could be applied, but thought of it only in connection with instruments of war, in which it is a very inadequate substitute for gunpowder.

He discovered the principle of the 'camera obscura' seventy-five years before Porta, to whom it is usually attributed.

It was because of the honour which had accrued to him in the estimation of scientists, as having discovered long before Moestlin the reason of the shaded light of the moon, that the demand was put forward by Lalande that Leonardo's manuscripts should be among the objects taken away from Milan when the French decided upon the removal of works of art.

In the science of botany in like manner his researches anticipated some of the results of the labours of posterity. A passage in the *Treatise on Painting* shows that he had by observation acquired a knowledge of the principles of phyllotaxis, the law of the quincuncial arrangement of leaves about their stalks, which is usually supposed to have been promulgated for the first time by Sir Thomas Browne in 1658 in his 'Hydriotaphia, etc., together with the Garden of Cyrus or the Quincuncial Lozenge or Network Plantation of the Ancients, artificially, naturally, mystically considered.' The interest in botany, deep and scientific in its very inception as is shown by the records of his early artistic work in

Florence, led him also to the discovery that the age of a tree may be told from the number of concentric rings visible in a section of its trunk. The record of this is contained in Section 829 of Ludwig's Edition of the *Treatise on Painting*. The credit of the discovery is usually given either to Nathaniel Grew or Marcello Malpighi, each of whom lived more than a century after the time of Leonardo.

The list of 'pre-imaginings' is necessarily incomplete. It might perhaps by research be extended considerably so vast was the circuit of his mind 'voyaging alone.' A single conjectural instance must suffice. As he was the forerunner of Newton so perhaps also in a measure of Einstein. Some far intellectual ancestor of the scientist, in beginning to explore the processes of thought which lead along the road to relativity, might conceivably in his initial attempt to describe what Leonardo in prescience styles 'the nature of time as distinguished from its geometrical definitions' (Scrivi la qualità del tempo separata della geometrica) (B.M. Arundel 263, fol. 176a) have arrived at just such a formula as that given by Leonardo: 'although time is numbered among the continuous quantities, yet being indivisible and without substance it does not fall entirely under the head of geometry which represents its divisions by means of figures and bodies of infinite variety, which are seen to be continuous in their visible and material attributes. But it agrees only with its first principles, that is with the point and the line. The point may be compared to an instant in time, and the line may be likened to the length of a certain quantity of time, and just as a line begins and ends in a point, so a certain given space of time begins and ends in an instant. And as a line is infinitely divisible so a space of time has the same divisibility; and as the divisions of the line may bear a certain proportion one to another, so also may the divisions of time.' (B.M. Arund. 263, fol. 173b, Richter 916.)

So far as it is possible to answer the question how one

brain came to shadow forth so many shapes of things unknown the manuscripts supply the answer in the record they present of his mental activity.

A page in the Codice Atlantico (folio 225r.b) reveals something of the workings of his insatiable desire after knowledge, showing how he sought practical opportunities for extending his information upon all matters which came within his horizon. It contains twenty-eight memoranda concerning books, instruments, maps and names of people from whom he hoped to acquire information about particular things, or who owned books which he wished to consult. Among them are:

'an algebra which the Marliani have – written by their father.'

'a book that treats of Milan and its churches, which is at the last stationer's on the way to Corduso.'

'get the arithmetic master to show you how to square a triangle.'

'get Messer Fazio to show his *De Proportione*.'

'get the friar of Brera to show his *De Ponderibus*.'

'various measurements – of Boccalino, of Milan and suburbs, of the Corte Vecchia, of the Castle, of San Lorenzo.'

'to ask Giovannino the artillery man how the tower of Ferrara is built without loopholes.'

'to ask Benedetto Portinari how people go on the ice in Flanders.'

'Alchino "on proportions" with a commentary by Marliano from Messer Fatio.'

'the measurement of the sun promised me by Messer Giovanni the Frenchman.'

'the book by Giovanni Taverna which belongs to Messer Fatio.'

'measurements of the canal locks and supports and large boats and the expense.'

'ground plan of Milan.'

'groups by Bramante.'

'Aristotle's Meteora in Italian.'

'try to get Vitolone which is in the library at Pavia, which treats of mathematics.'

'find a master who knows about water and get him to explain the repairs and what they will cost, and a lock and canal and a mill in the Lombard fashion.'

'a grandson of Gian Angelo the painter has a book on water which belonged to his father.'

'Paolino Scarpellino, called Assiolo, is a good master of water.'

The subjects on which his thoughts apparently are turned are comparatively few, hydraulics, architecture and mathematics, but they are taken from a single page of the manuscript as presenting a record of his mental activity. It was perhaps on one of the occasions when nature protested at such a regimen that he wrote:

'O Lionardo perchè tanto penate?'

How he gathered knowledge from works of classical and mediæval learning as well as by observation, the list of forty names of books on a page of the Codice Atlantico (folio 210r.a) bears witness.

§ 7

The manuscripts, however, not only contain the record of studies encyclopædic in their range, but they also reveal Leonardo as a master of the power of literary expression, and in their portrayal of personality, in the fragments of letters and other passages they present a record as intimate and as convincing as that in Benvenuto Cellini's Memoirs, the differences in subject matter being due to the mentality of the writers.

As in his art he created images of beauty which have a strange power to arrest the imagination and which serve as symbols rather than types, so also with the written word; continually it seems the fragments of treatises reveal the spirit of the scientist working in sustained harmony with that of the literary artist, thus to make of the dry facts which research has gathered a fiction which should express great things (farò una finzione che significherà cose grandi). We see it especially in the fragments intended apparently to serve as general introductions to treatises on anatomy and geology, in that in which he traces out the record of the natural history of man from the conception and growth of the embryo to birth and then the development, and finally the gradual wasting of the body, and in that in which he reviews the question of the extent and duration of the deluge in the light of the evidence presented by the existence of marine shells, or in such a fragment as that of the treatise on water in Manuscript A (folio 55b) in which, following the conception held by Paracelsus, he institutes a far-reaching comparison between the earth as a vast organism and the lesser microcosm of man: 'as man has within him bones as the supports and framework of his flesh, the world has the rocks the supports of the earth; as man has within him a pool of blood in which the lungs rise and fall in breathing the body of the earth has its ocean tide which also rises and falls every six hours as though the world were breathing; as from that pool of blood proceed veins which go ramifying through the human body, so the ocean sea fills the body of the earth with an infinite number of veins of water.' The fact of the body of the earth having no counterpart to the muscles of the human body he accounts for by the fact of the earth's stability rendering the presence of muscles unnecessary, and claims that in all other points they are much alike. Amid the comparatively arid details of anatomical research at Windsor we come upon such a sentence as this, 'tears come from the heart, not the brain.' The sentence is demonstrably true as

denoting the source of the tear ducts, but the restricted sense would seem to merge imperceptibly into a wider import.

As in comparison, so in contrast, he marshals his forces augustly, his pen testifying as it were in its own despite to the supremacy of painting among the arts: 'thirst shall parch thy tongue and thy body shall waste through lack of sleep and sustenance ere thou canst describe in words that which painting instantly sets before the eye.'

The passages in which he seeks to define the antithesis between the liberal arts and the well-known descriptions of how certain subjects, such as a tempest, a battle and a night scene, should be represented in painting, which are themselves pictures in the medium of prose, offer convincing evidence of his analytic and descriptive power. It is, however, within the narrower limits of the short sentence and the phrase that his art is most luminous and impressive. Some of these contain images which once perceived haunt the memory as some music lingers in the ear. A simile such as that of 'the peacemaker – the ebb and flow of the sea' is a curious anticipation of the thought that was in Keats when he wrote:

> 'The moving waters at their priest-like task
> Of pure ablution round earth's human shores.'

Such vignettes of description as that of the lily set down by the banks of the Ticino, or of the mirror that bore itself proudly holding the queen mirrored within it, are framed in simplicity akin to that which animates Heine in such a lyric as 'Ein Fichtenbaum steht einsam.' Others limpid as these reveal the dominance of the moral purpose.

'Iron rusts from disuse; stagnant water loses its purity, and in cold weather becomes frozen; even so does inaction sap the vigour of the mind.'

'O thou that sleepest, what is sleep? Sleep is an image of death. Oh, why not let your work be such that after

death you become an image of immortality; as in life you become when sleeping like unto the hapless dead.'

Others again reveal the existence of a degree of practical wisdom concentrated upon the ordinary affairs of life which is in entire harmony with the fact that the list of his mechanical inventions includes such obvious utilities as a turning spit for roasting meat, file-cutting and stone-cutting machines, instruments for drawing wire and twisting ropes, an inflatable jacket for use in case of sudden immersion, bow-compasses and locks for canals. An interesting example is 'happy is that estate which is seen by the eye of its master' in which by inference he suggests the evils of absentee landlordism.

Horace might have framed such a tribute to moderation of habit as is contained in the line 'small rooms or habitations discipline the mind, large ones lead it astray.' Perhaps also he might have subscribed to Leonardo's dictum that 'wine is good, but water is preferable at table,' or to his counsels in the matter of diet expressed in three short distiches: 'If you wish to keep in health, follow this rule: do not eat without appetite; masticate well, and in order that your food may agree with you let it be well cooked and simply prepared. Whoever takes medicine is ill advised.' Should the concluding words seem to need any justification it may be found in a sentence in the Windsor Manuscripts: 'I teach you to preserve your health, in which you will succeed the better the more you keep away from physicians, for their compounds are the work of alchemists.' The absurd claims of the votaries of pretended sciences of mediævalism, such as astrology, alchemy, necromancy, are the object of his fiercest denunciation. The advocacy of the last he characterizes as being of all human discourses the most foolish. That, however, he recognized at their due value the true functions of medical science, as distinguished from the boluses of the alchemist, is to be inferred from a sentence in the Trivulzio Manu-

script which runs, 'medicine is the restoring of harmony to elements at variance, sickness being the discord of the elements infused within the living body.' So also he makes short work of the pretended science of palmistry in a single sentence: 'you will see great armies slaughtered in the space of an hour where in each man the signs of the hands are different.'

The manuscripts, judged purely from the standpoint of their revelation of personality, are full of strange contrasts. They present meticulous household accounts balanced day by day, and such indifference to the things that money can buy as finds expression thus, 'Call not that riches which may be lost; virtue is our true wealth, and the true reward of its possessor. . . . As for property and material wealth, these you should ever hold in fear; full often they leave their possessor in ignominy mocked at for having lost possession of them;' or a personal note in proud protestation, 'pray hold me not in scorn! I am not poor! Poor rather is the man who desires many things. Where shall I take my place? Where in a little time from henceforth you shall know.'

Querulous complaints of the misdeeds of apprentices have to be reconciled with passages that display such utter indifference to personal discomfort and suffering that they might be the utterances of some Indian fakir, e.g. 'patience serves as a protection against wrongs as clothes do against cold . . . grow in patience when you meet with great wrongs, and they will then be powerless to vex your mind.' 'Intellectual passion drives out sensuality' (la passione dell' animo caccia via la lussuria) he wrote on a page of the Codice Atlantico. On the same page we find one of the very few coarse jests that occur in the manuscripts. Notes occurring on the same page were not necessarily written at the same time, but the juxtaposition nevertheless brings into sharp relief the contrasts of his nature.

In studying the manuscripts as personal records one

cannot but be always conscious of an extraordinary sense of intimacy. With the possible exception of certain fragments of treatises they were not written with any thought of publication. No merchant ever trafficked in his heart. They were primarily the results of his studies and researches made for his own need of reference, and also a memorizing of his thoughts made in order to satisfy his natural desire of expression. Therefore, as he explains in the opening lines of the manuscript in the British Museum (Arundel 263), there are many repetitions 'because the subjects are many, and the memory cannot retain them, and say "this I will not write because I have already written it."' The utter formlessness of the result may be deterrent to some, but it is inherent in the making of notebooks.

In a fragment in the Codice Atlantico, written in the form of an introduction, when in a synthetic mood he thought of arranging a section of his scattered notes, he meets the hypothetical charge that owing to the fact of his being without skill in letters he cannot properly treat of the matter which he sets forth, by the statement that his subjects are such as are to be treated of by experience rather than by words, by which test the true may be discerned from the false, and men are led to look only for things possible, and this with due moderation. Used as they are with reference primarily to the results of researches the words do not admit the inference that experience was in any sense a controlling factor in the composition of the other subject matter. They throw no light on vexed questions of interpretation. But in considering personality as revealed in the manuscripts such questions have little or no import. The evidence of fragments of letters as to the nature of which there is no doubt is more than sufficient for judgment.

In these always, as at times in other portions of the manuscripts, we seem to hear the very accents of his voice – clear-toned, as we find it in that passage in the Windsor Manuscripts in which he recounts the labour that has gone to the

preparation of his anatomical drawings, which commences, 'I wish to work miracles – I may have less than other men who are more tranquil, or than those who aim at growing rich in a day. I may live for a long time in dire poverty' . . . and ends with the sublime apologia for all that is left unexplained, 'I have not been hindered either by avarice or negligence, but only by want of time;' or as in a passage in the Codice Atlantico (folio 277v.a) where, in the middle of a dissertation on the law of complex shadows, we come suddenly upon an exclamation which it is natural to connect with his work on the Sforza statue: 'though the marble suffer ten years I would not wish to wait for my payment beyond the term of the completion of my work.' The letters tell of his hopes and aspirations, fears and perplexities. That written to solicit employment in the Court of Milan, in which the offer to construct the statue of Francesco Sforza follows a long list of projected undertakings in war by land and sea, and in the arts of peace such as architecture, engineering, sculpture and painting, shows something of the wide range of his genius, wings poised for a flight, fearless in its readiness to give a demonstration of his power to construct any of these things either in the park of Milan or wherever else his Excellency should choose. So also the fragments of later letters to Ludovic Sforza reveal the actual conditions of his life at the Sforza Court, its carking cares when his salary was in arrears and his assistants were clamouring to be paid and he was obliged to abandon for a time his greater undertakings. As in the fragment in the Codice Atlantico (folio 315v.a), 'it vexes me greatly that the fact of having to earn my living has forced me to interrupt the prosecution of the work which your Lordship entrusted to me; but I hope in a short time to have earned enough to be able with a calm mind to satisfy your Excellency, to whom I commend myself; and if your Lordship thought that I had money your Lordship was deceived, for I have had six mouths to feed for thirty-six months and I have had fifty ducats.' The

conditions are expressed with even greater poignancy on folio 335v.a of the same manuscript, which having been torn down the middle presents in the broken halves of sentences a record fragmentary indeed, and perhaps seeming for this reason eloquent as though wrung from nature's deep reserve: 'My Lord, knowing the mind of your Excellency to be occupied . . . to remind your Lordship of my small matters and the arts put to silence . . . that my silence was the cause of making your Lordship despise . . . my life in your service, I hold myself ever ready to obey . . . of the horse I will say nothing because I know the times . . . to your Lordship how I was two years in arrears with my salary for the . . . with two skilled workmen whose salary and expenses I had always paid . . . that at last I found I had advanced the said work about fifteen lire . . . works of fame by which I could show to those who shall see them that I have been . . . everywhere, but I do not know where I could bestow my work to . . . I having been taken up with gaining a living . . . not being informed how it is, I find myself . . . you remember the commission to paint the Camerini . . . I conveyed to your Lordship only requesting . . .' Before the self-revelation of these passages of a life of penury, repression and stern concentration the insouciant figure of Vasari's biography loses some of its colouring. The draft of a letter to the Commissioners of Buildings at Piacenza shows him in an altogether different mood – wise, cautious, witty.

The Commissioners were apparently on the point of bestowing the commission for the construction of the bronze doors for the Cathedral, and he gives them sage counsel as to the prominence which the work will have in the city from its position when completed, and as to the importance therefore of their exercising great care in deciding who shall execute it, and not hastily coming to a decision, lest by their choosing one who may be incompetent that which was intended for the honour of God and of men should be turned

to great dishonour of their judgment and of their city, which being a place of importance and on a main route was the resort of innumerable foreigners. After specifying the incongruous occupations of those who have already applied for the commission he concludes in a vein half of regret half of *badinage*, which *mutatis mutandis* might have been written by George Bernard Shaw: 'There is no one who is capable – and you may believe me – except Leonardo the Florentine, who is making the horse in bronze of the Duke Francesco, and you must not reckon upon him, for he has work to do that will last him all the days of his life, and I doubt whether being so great a work he will ever finish it.'

We may pass over the letters and drafts of letters to the French governor of Milan, Charles d'Amboise, to the President of the Water Commission at Milan and to Francesco Melzi, as being concerned only with commissions and private affairs of little import, and notice the decline in later years of the power of rising above adversity visible in the drafts of letters written when at Rome to his patron Giuliano de' Medici, who then lay ill at Fiesole, to whom, after congratulating him on the news of his recovery which has almost banished his own sickness, he unfolds the story of the misdeeds of his German apprentice as the reason why he has been unable to satisfy his wishes. The theme could have had very little interest for his patron, who lay on his deathbed.

The opening words of a sentence at the commencement of a letter in the Codice Atlantico (folio 270r.c), written apparently to demonstrate his fitness to work on the fabric of the Cathedral at Milan, defines what may be regarded as his considered attitude to medical science as distinct from its abuses: 'as medicines skilfully compounded cure the ills of the body, so the physician architect can minster to those of the Duomo.'

The latest of the dated references in the manuscripts is

the note written at the top of a page in the Codice Atlantico (folio 249r.b): 'On the twenty-fourth of June, St. John's Day, 1518, at Amboise in the palace of Cloux.' The page is entirely filled with geometrical definitions and calculations.

BELIEF

The divergencies between the texts of the first and second editions of Vasari's *Lives*, which appeared in 1550 and 1568, present a fertile field of research for the student. During the intervening years the biographer acquired additional information from various sources, in the light of which he recast parts of his narrative. There is also seen the working of a natural tendency to greater caution or deliberation associated with the more reflective years. In the case of the biography of Leonardo the differences centre mainly round the question of his religious belief. As the first edition of Vasari did not appear until more than thirty years after Leonardo's death, there is necessarily no sense of personal contact. His sources as regards the Florentine years were certainly Florentine and as to the rest most probably Francesco Melzi, whom he knew as 'a beautiful and gentle old man' and whose personality seems somewhat to pervade and conventionalize this section of Vasari's narrative. In the part which treats of Leonardo's youth in Florence, after offering as an example of his caprices the fact that philosophizing of natural things he set himself to understand the properties of herbs, the motions of the heavens, the course of the moon, and the rising of the sun, the text in the first edition continues, 'for his cast of mind was so heretical that he did not adhere to any religion, deeming perchance that it was better to be a philosopher than a Christian.' The proofs of heresy offered would seem strange, but they were analogous to those which obtained in the case of Giordano Bruno. The subsequent omission of the sentence shows, according to Milanesi, that Vasari realized that he had been deceived by common report, which attached the stigma of heresy to the study of natural science. The fact that on reflection the statement was omitted from the second edition of Vasari's work surely outweighs in significance as a biographical item the fact of its appearance in the first. In another passage we find that in the second

edition words, derived presumably from Melzi, which imply an eleventh-hour return to orthodoxy have been so changed as to minimize the divergence, and in their final form amount only to a quickening of interest in spiritual things.

To pass from the biographer's witness of these things to the evidence of Leonardo's own manuscripts is to enter at once into a freer, serener air. In lieu of all that is conventional in talk of confession and penitence we have, self-portrayed, the absorption of the scientist intent to follow out primary causes in the full freedom which was won by the Renaissance. To the high sanction of this he renders testimony: 'How admirable thy justice, O thou first mover! Thou hast not willed that any power should lack the processes or qualities necessary for its results.' (Manuscript A, 24r.)

While we may say with reference to Vasari's earlier utterance as to Leonardo having thought it better to be a philosopher than a Christian that his manuscripts show that he did not find the two standpoints necessarily incompatible, it is equally true that they show also that in considering the phenomena of the universe his thoughts were centred primarily on natural causes.

The Renaissance had begun in the study of nature. In art in its first naïve attempts to free itself from the conventions in the representation of form and colour imposed by tradition, and to paint what the artist saw. In literature in the bird-like music of Provençal poetry, where the singers seem inspired by a new consciousness of the beauty of spring and vernal delights. By degrees the spirit of inquiry passed from the consideration of the various manifestations of the processes of nature to the study of the laws which control them, and this assertion of the freedom of man's intellect received an immense stimulus from the results of the revival of classical learning, in which pursuit Florence was from the first pre-eminent. As this store stood revealed the searchers learnt that the newly-won freedom was really

the old. Already 'there had been a time when men had used all their faculties of mind and imagination without fear or reproof; not restricted to certain paths or bound by formulas, but freely seeking for knowledge in every field of speculation, and for beauty in all the realms of fancy.'[1] After the discovery of this fact there could be no compromise with the claims of mediæval authority to impose fetters on thought and restrict the mind from following out its logical processes. In contradistinction, however, to the effect of the discovery of classical literature the masterpieces of the art of antiquity exerted on the whole a restraining influence by virtue of their supreme symmetry and repose. Leonardo in a well-known passage postulates for the artist freedom of endeavour subject only to the guiding of nature, which any such preoccupation with the study of classic art would tend to impair.

The contrast apparent between the high ethical teaching of Greek philosophy and the flagrant corruption of morals of some of the holders of ecclesiastical authority aided the establishment of the full intellectual independence of Renaissance thought, and is in part responsible for the sceptical tendency visible in the later stages of its progress. Vasari, writing biographies of artists and viewing his subjects primarily from this standpoint, has a restriction of outlook which would prevent him from seeing the true proportions of Leonardo's activities even had the contents of his manuscript been available to him. So he is apologetic or bemoans the wayward inconstancy of genius where he touches in brevity upon Leonardo's scientific studies, and in an entirely apocryphal account of a visit paid to Leonardo at the time of his death by the French King represents him as telling Francis how he had offended God and mankind in not having laboured at his art as he ought to have done.

'As a well-spent day,' wrote Leonardo in the Trivulzio Manuscript, 'brings happy sleep, so life well used brings happy death.' Had his artistic activity been more continuous

[1] Jebb.

his name would not have served as it does as a supreme example of man's intellectual capacity, a link in his single achievement between the artistic glory of the Age of the Renaissance and the era of scientific discovery whose beginnings it heralded. The outlook of his manuscripts is primarily that of the scientist, intent to pursue the search for knowledge whithersoever it might lead him; in revolt against all restrictions upon the free use of the human intellect imposed either by tradition or authority, his primary purpose being the observation of natural phenomena. His earliest dated drawing, the study of landscape in the Uffizi, Tuscan in character, which bears the date – 5 August 1473 – shows it in the careful stratification of the rock. This study of geology, in inception part of his projected artistic equipment, was already before he left Florence continued in independence of it, the place references in such passages of his manuscripts as describe the results of these researches being for the most part to scenes in the valley of the Arno, e.g. the gravel deposits near Monte Lupo, the tufa stone where the river turns towards Castel Fiorentino, the bluish clay of the cutting made by the river at Colle Gonzoli. In the course of these studies of the changes in the earth's surface he is led to conclusions which run altogether counter to accepted beliefs as to the period of the duration of the world. Thus the time requisite for the Po to have cut its channel is shown by the calculation from its visible action to have far exceeded the whole period of its existence according to what was then the teaching of the Church. His study of the effects of the action of time upon the surface of the earth enables him to envisage a time when the waters covered it, when, as he says, 'above the plains of Italy where now the birds fly in flocks fish were wont to wander in large shoals.' And again in another passage, 'all the plains which lie between the sea and the mountains were formerly covered with salt water.'

But the consideration of natural causes leads him to express a doubt whether after the earth first emerged it was

again covered by the waters, or, as he says, whether the Flood which came in the time of Noah was universal or no. In debating this question he follows the inductive method of reasoning. 'We have it in the Bible that the Flood was caused by forty days and forty nights of continuous and universal rain, and that this rain rose ten cubits above the highest mountain in the world. If, however, it had been the case that the rain was universal, it would have formed in itself a covering round our globe, which is spherical in shape; and a sphere has every part of its circumference equally distant from its centre, and therefore, on the sphere of water finding itself in the aforesaid condition it becomes impossible for the water on its surface to move, since water does not move of its own accord unless to descend. How then did the waters of so great a Flood depart if it is proved that they had no power of motion? If it departed how did it move unless it went upwards?' 'At this point,' he adds, 'natural causes fail us, and therefore in order to resolve such a doubt we must needs either call in a miracle to our aid or else say that all this water was evaporated by the heat of the sun.'

In this there is nothing of iconoclasm. The conclusions follow temperately. The scientist is simply searching for the truth. A passage in the Leicester Manuscript states clearly and cogently why the fact of the presence of marine shells in the mountains of Italy cannot be regarded as affording any confirmation of the story of the Flood, because as the cockle is incapable of swimming, or of any more rapid movement than that of the snail when travelling by means of a furrow in the sand at the rate of about two yards a day, it could not in forty days have travelled a distance of 250 miles from the Adriatic to Monferrato in Lombardy, where the shells were found. Nor could these have been carried there by the waves, because their weight is such that they could not move except upon their base, and that they were living when they went there is shown by the fact of the shells being found in pairs. 'If,' he says, 'the deluge were to have

carried shells three and four hundred miles from the sea, it would have carried them mixed with various other natural objects heaped together; but we see at such distances oysters all together and sea-snails, and cuttle-fish, and all the other shells which congregate together. . . . And if you were to say that these shells were created and were being created continually in such places by the nature of the spot and of the heavens which might have some influence there, such an opinion cannot exist in a brain of much reason, because the years of their growth are here numbered on their shells, and there are to be seen large and small ones which could not have grown without food, and could not have been fed without motion, and yet here they could not move.'

That Leonardo's mind moved by gradual stages to these conclusions as the result of a long course of study of clay deposits and river cuttings is to be inferred from the fact that he states in a passage in the British Museum Manuscript, which from the fact of the writing being of the early period is believed by Dr. Richter to be anterior to the Leicester Manuscript by thirty years or more, that of two lines of shells the one was formed when the earth was submerged under the sea, and then the deluge made the second. This position was afterwards abandoned, but the passage is significant as showing that he had no bias against tradition, that he approached the consideration of phenomena with a single purpose, namely to attempt to discover natural causes. It is as the result of following out a sequence of natural causes that he finds the evidence of the marine shells, apart from the question of the miraculous, to be conclusive against the dogma of the universality of the Flood. But though faithful to the findings of scientific truth he does not lay stress upon the antagonism, rather seems expressly to disclaim it. In one of the anatomical manuscripts at Windsor, where he has attempted to describe the natural origin of the soul of man, which at first lies dormant and under tutelage of the soul of the mother, abandoning, as he says, the rest

of the definition to the imaginations of friars, 'those fathers of the people who know all secrets by inspiration,' he adds these significant words: 'Lascio star le lettere incoronate, perchè sono somma verità.' 'I speak not against the sacred books, for they are supreme truth.' Richter would interpret the expression 'le lettere incoronate' to mean, not probably the Bible only, but also the works of the early Fathers and those recognized as sacred by the Roman Church. It would, however, seem more probable that Leonardo was using the words in a more restricted sense. He would not lightly admit to the category of the works which he characterized as containing supreme truth. He was, as his manuscripts show, in continual revolt against the restrictions which ecclesiastical authority sought to interpose upon the freedom of thought: 'with the crowd of sophists you deceive yourself and others, despising the mathematical sciences in which truth dwells, and the knowledge of the things included in them. And then you occupy yourself with miracles, and write that you possess information of the things of which the human mind is incapable and which cannot be proved by any instances from nature. And you imagine that you have wrought miracles when you spoil a work of some speculative mind, and do not perceive that you are falling into the same error as that of a man who strips a tree of the ornament of its branches covered with leaves, mingled with the scented blossoms or fruit . . .' (Windsor MSS., Richter 1210). In the passage of which these lines form part Leonardo is declaiming against the practice of making epitomies, but in view of the fact that the manuscript in which it occurs treats of anatomy, it may perhaps be possible to discern a reference to the fact that in his anatomical researches Leonardo had incurred the censure of ecclesiastical authority. This occurred while he was in Rome, whither he went in 1513, after the election of Giovanni de' Medici as Pope Leo the Tenth. As the personal notes in his manuscripts show, he had schooled himself to endure injuries

with an extraordinary degree of patience, and this is seen in evidence in his notes about the malpractices of two of his assistants in Rome, of one of whom, Giovanni, he wrote, 'this other has hindered me in anatomy, blaming it before the Pope, and likewise at the hospital.'

Freedom to dissect the human body had scarcely been won in Italy, and it may have been that Leonardo owed it to the fact of the contents of his manuscripts having remained unknown to his contemporaries that the results of his studies in anatomy were never made the occasion for an indictment. That while in Rome he was given no commission at all commensurate with his powers may be attributed, in part at least, to prejudice created by the information laid against him. The fact that the study of human anatomy, begun in his youth in Florence as part of his equipment as an artist, was continued, apart from all thought of artistic representation, for forty years as occasion offered, despite obloquy and misrepresentation, testifies to the continual indwelling in him of the thirst for knowledge which in a sentence in the Codice Atlantico (folio 119v.a) he has stated to be 'the natural desire of good men.' 'If it please our great Author,' he says in a passage in the Windsor Manuscripts (R. 798) intended to serve as an introduction to his Treatise on Anatomy, 'I may demonstrate the nature of men and their customs in the way that I describe their figure,' as a means to which he would set forth in twelve figures, after the plan followed by Ptolemy in his cosmography, that of this lesser world, dividing them up into limbs as he divided the whole world into provinces and then considering the function of each part in every direction. Of the tenacity with which he held to his purpose we may gather from the concluding words of another passage in the Windsor Manuscripts (R. 796), in which, after defining the necessary stages of the demonstration, he adds:

'Concerning which things, whether or no they have all

been found in me, the hundred and twenty books which I have composed will give their verdict "yes" or "no"; in these I have not been hindered either by avarice or negligence, but only by want of time.'

In three terse sentences which occur on a page of the Windsor Manuscripts (R. 682), the first of which strikes an avowedly personal note, Leonardo gives free rein to his indomitable spirit: 'obstacles cannot bend me'; 'every obstacle yields to effort'; 'he who fixes his course by a star changes not.' The star was the lamp of knowledge, truth as he conceived it, and where it beaconed he followed, walking fearlessly yet reverently as in God's presence. There is in his writings an austerity combined with such oneness of endeavour as brings to mind the precept of Polonius: 'This above all: to thine own self be true.'

'The knowledge of past time and of the position of the earth is the adornment and the food of human minds.' So he wrote in the Codice Atlantico (folio 373v.a), and it is in this study of natural theology by the light of nature and reason that his spirit spent itself most willingly. We may see in him the mood of the ascetic and the mystic. 'Entbehren sollst du, sollst entbehren.' So 'if you kept your body in accordance with virtue your desires would not be of this world' (MS. B. 3v.), and 'the senses are of the earth, the reason stands apart from them in contemplation.' But his chosen mood is the practical. The recurrent message is to use life as an opportunity that soon passes. 'He who does not value life deserves it not' (MS. I, 15r.). 'Life well spent is long' (MS. Trivulzio). Work he considers as the solvent for wellnigh every evil Few have taught salvation by works more convincingly. 'Intellectual passion drives out sensuality' (C.A. 358v.a). It offers that hope of diuturnity which has ever been an incentive to noble needs. 'It should be our pleasure that our days be not squandered nor suffered to pass away in vain, and without meed of honour,

leaving no record of themselves in the minds of men' (C.A. 12v.a).

'Why not let your work be such that after death you become an image of immortality: as in life you become when sleeping like unto the hapless dead' (C.A. 76v.a).

He cared nothing for the dogmas of mediæval theology, and with the hagiology of the Roman Church he had no temperamental sympathy. By contrast with the aloofness from the world which these betoken we may discern the warm humanity, kindliness and mordant humour shown in such a passage as this from the Windsor Manuscripts (R. 1358): 'If you meet anyone who is virtuous and good, do not drive him from you; do him honour, so that he may not have to flee from you and be reduced to hiding in hermitages, or caves or other solitary places to escape from your treachery; and if there should be any such found among you, do him honour, for these are your Gods upon earth; these deserve statues from us and images; but remember that their images are not to be eaten by you as is still done in some parts of India: where when the images have, according to them, performed some miracle, the priests cut them in pieces, being of wood, and give them to all the people of the country, not without reward; and each one grates his portion very fine and puts it upon the first food he eats, and thus believes that by faith he has eaten his saint, who then preserves him from all perils. What do you think here, Man, of your own species? Are you as wise as you believe yourself to be? Are these things to be done by men?'

This passage is typical of the strangely divergent character of Leonardo's writings in that it passes abruptly from a profound moral exhortation to the recording of a custom of which the interest is primarily ethnological.

He may have derived it from some account apocryphal perhaps of some traveller as yet unidentified, the practice itself being as yet uncorroborated by research. The note of

wonder and astonishment with which it concludes is common to the important section of aphoristic utterances known as 'the prophecies,' many of which are concerned with religious rites and ceremonies. In Italy, too, there was food for wonder in a background full of strange contrasts and divergencies, a Borgia in the Vatican, Savonarola suffering martyrdom. In the year 1512, the year preceding that of Leonardo's journey to Rome, the monk Martin Luther had made pilgrimage there. The thunders of Wittenberg were as yet hidden deep in the womb of time. He had gone to Rome, we are told, with feelings of the most profound reverence, but was influenced by the spectacle of Italian corruption and immorality there presented. He returned to develop with new force the doctrine of justification by faith, which was opposed, as has been said by Sir Richard Lodge, not so much to the dogmas as to the practices of Roman Catholicism. Five years later, roused by events to the need for action, he nailed his theses against the sale of indulgences on the door of the church of Wittenberg, maintaining there for all time that repentance was a necessary condition of pardon for sin, and that without it the Pope's indulgence was altogether impotent. To Leonardo, then in quiet anchorage in the service of Francis the First at Amboise, it is perhaps unlikely that any echo of this distant thunder ever came. But he too had nailed his theses to the door. It is in the strange enigmatic section of his writings known as 'the prophecies' that they cluster most thickly. Trenchant as Luther his denunciation, e.g. 'of friars who, spending nothing but words, receive great gifts and bestow Paradise.' 'Invisible money,' he says, 'will procure the triumph of many who will spend it,' or this entitled 'Of selling paradise': 'An infinite number of men will sell publicly and unhindered things of the very highest value without leave from the Lord of these things, which were never theirs nor in their power; and human justice will take no count of this.'

Others of 'the prophecies' which fall naturally under the

division entitled 'ceremonies,' as they pass in review tersely and epigrammatically many of the distinctive features of the dogma and ritual of Roman Catholicism, serve to show very clearly that as regards most fundamental points the cast of his mind was essentially Protestant.

A sequence of examples may serve to establish this:

'Of Christians.'

'There are many who hold the faith of the Son and only build temples in the name of the Mother.'

'Of the worshipping of pictures of saints.'

'Men shall speak with men who shall not hear them; their eyes shall be open and they shall not see; they will speak to them and there shall be no reply; they will ask pardon from one who has ears and does not hear; they will offer light to one who is blind, and to the deaf they will appeal with loud clamour.'

'Of the religion of friars who live by means of the saints who have been dead for a long time.'

'Those who are dead will, after a thousand years, be those who will make provision for many of the living.'

'Of priests who say Mass.'

'Many shall there be who, in order to practise their calling, shall put on the richest vestments, and these shall seem to be made after the manner of aprons.'

'Of friars who hold confession.'

'The unhappy women of their own accord will go to reveal to men all their wantonness and their shameful and most secret acts.'

'Of the churches and habitations of friars.'

'There will be many who will abandon work and labour and poverty of life and possessions, and will go to dwell among riches and in splendid buildings, pretending that this is a means of becoming acceptable to God.'

'Of the thurible with incense.'

'Some shall go about in white vestments with arrogant

gestures, threatening others with metal and fire, which yet have never done them any harm.'

'And many have made a trade in deceits and feigned miracles, cozening the foolish herd, and if no one showed himself cognizant of their deceits they would impose them upon all.'

'Farisei frati santi vol dire.' '*Frati santi* spells Pharisee.'

The cumulative effect of these passages far exceeds the importance of any of them taken singly. Leonardo attacks flagrant ecclesiastical abuses; he is anticlerical in the sense that he is an unsparing critic of the shortcomings of priests and friars. That same power of characterization which revealed itself in his many drawings of the perverse and the unusual bordering upon the grotesque – drawings which led Ruskin to say of him that he debased his finer instincts by caricature – is seen in a fresh medium, biting and incisive.

He seems to have hugged a certain prejudice against the regular clergy, thus in the *Treatise on Painting*, Section 27, after speaking with great asperity of a certain class of hypocrites among the host of fools who are continually exercising their ingenuity to deceive themselves and others, but who in reality deceive themselves more than they do their neighbours, he adds: 'I am alluding to such people as those who blame painters for devoting saints' days to the study of matters which have to do with the knowledge of nature and for taking pains to acquire as much of that knowledge as they can.'

The personal note rings so strongly throughout the whole passage that we are led to assume that Leonardo incurred such censure and is here kicking against the pricks. If we consider the magnitude of the sum of his researches in the sciences which are concerned with the knowledge of nature, results arrived at in time won hardly from his other work,

we may in a measure discern how intolerably galling to him would be any such restrictions imposed upon the self-surrender of his days.

Art veils her processes and the completed result offers a less sure guide to the mentality of the artist; but Leonardo's work in art is so truly in the lineage of Giotto and Masaccio, in that it seeks to produce its effects by the free play of human movement, that it offers no contradiction to the evidence presented by the manuscripts as to his attitude to matters of faith and doctrine. How completely it satisfied the religious instincts of his contemporaries we know from the testimony of no less acute an observer than the famous Isabella d'Este, styled by a contemporary 'la prima donna del mondo,' who, writing to the Carmelite Vicar-General Fra Pietro da Nuvolaria to get him to try to obtain a picture from Leonardo for her studio, said that what she really desired most was a little picture of the Madonna 'devout and sweet as is his wont' (devoto e dolce come è il suo naturale). The many drawings which Leonardo made for a picture of the Virgin with the Child playing with a cat, the 'Madonna del Gatto,' some in the British Museum, some in the Uffizi, show how entirely the strength of his art in this form of composition is based in naturalism, the free play of natural movement dominating by virtue of its grace and spontaneity.

It is, however, in the structure of the Last Supper that the break with tradition is most significant. The germ of this composition dates back to the time of Leonardo's youth in Florence. On a sheet of drawings in the Louvre we find a sketch for the figure of Christ, pointing with eloquent finger to the dish, and also various studies for figures in the Adoration of the Magi, which is a work of his first Florentine period. We need only to think of the examples of the same composition as treated by Giotto, Andrea del Castagno, and others which met his eyes whilst the subject was germinating in his mind, in order to realize what an advance his work

shows in the realism of natural movement. Haloes, hierarchic solemnity, are gone. The arrangement is built up with a new certainty on mathematical principles. In the interaction of the characters there is revealed a simplicity of motive such as proceeds from a mind which attaches more importance to works than to dogmas. The disciples seem men swayed by a single impulse resulting from the words which they have just heard uttered by Christ. In the rendering of this Leonardo has shown how triumphantly he could solve the problem which he enunciated in the sentence in the *Treatise on Painting*, where he defined the painter's two chief objectives to be man and the intention of his soul, the former being, as he stated, easy, the latter hard, 'because he has to represent it by means of the movements of the limbs.'

Leonardo was, as I have tried to show, an unsparing critic of what he conceived to be the corruptions of the mediæval Church. So incisive were these criticisms that it becomes the more surprising that Vasari's second edition should have contained a substantial modification of the strictures of the first respecting Leonardo's religious opinions. Heresy, as has been said, is in itself a strong manifestation of religious sentiments, and there is evidence enough in Leonardo's manuscripts to support the charge. The 'heresy' of Leonardo, however, has much in common with that of the Reformers as well as with that of the Philosophers.

In a few thoughts of Leonardo which dwell deepest in the memory – those which touch the issues of life with an entirely personal note – there is a deep pervasive harmony.

Some, with a wider vision, look beyond the present to the Creator of all:

'Our body is subject to heaven and heaven is subject to the spirit.'

Some, surveying the realm of nature, hymn the reign of universal law:

'How admirable thy justice, O thou first mover! Thou hast not willed that any power should lack the processes or qualities necessary for its results.'

Others express succinctly and humbly the eternal verities of the Christian faith, e.g. the belief in a personal Deity:

'I obey thee, O Lord, first because of the love which I ought reasonably to bear thee; secondly because thou knowest how to shorten or prolong the lives of men.'

the doctrine of salvation by works:

'Thou, O God, dost sell unto us all good things at the price of labour.'

and of rest after labour:

'As a well-spent day brings happy sleep, so life well used brings happy death.'

On a sheet of the Windsor Manuscripts, on which also occur notes in Leonardo's own hand, there are some notes by a pupil, Johannes Antonius di Johannes Ambrosius de Bolate, which seem to be a record of sayings by the master, so surely do they reveal the inspiration of his teaching.

'He who lets time pass and does not grow in virtue the more I think of it the more I grieve. No man has it in him to be virtuous who will give up honour for gain. Good fortune is valueless to him who knows not toil. The man becomes happy who follows Christ; there is no perfect gift without great suffering. Our glories and our triumphs pass away. Foul lust and dreams and luxury and sloth have banished every virtue from the world: so that our nature, wandering and perplexed, has almost lost the old and better track. Henceforth it were well to rouse thyself from sleep. The master said that lying in down will not bring thee to fame, nor staying beneath the quilts. He who without fame

consumes his life leaves no more trace of himself on the earth than smoke leaves in the air, or foam upon the sea.'

'The man becomes happy who follows Christ; there is no perfect gift without great suffering.'

(Colui si fa felice che Christum vestiga; perfetto dono non s'à senza gran pena.)

So might have written Savonarola, who was Leonardo's contemporary to a year, who proclaimed that Jesus Christ was the King of Florence, and strove so to banish sin and perfect man's nature by a living faith as to make His kingship a reality.

Not a few of Leonardo's 'prophecies' might well have fallen from the lips of the mystic and seer who foretold the woes that were to come upon Italy, woes which did come as aftermath of the ill-omened expedition of Charles the Eighth.

TRAVELS

More than forty years have elapsed since Dr. Richter, on the strength of evidence contained in certain pages of the Codice Atlantico, propounded the theory, first in an article 'Leonardo im Orient' in the *Zeitschrift für Bildende Kunst*, Vol. XVI, afterwards in a more modified form in his edition of the Literary Works, that previous to Leonardo having gone to Milan he made a journey to the East, and was for a time in Asia Minor in the service of the Sultan of Egypt as an engineer, the evidence being in the form of certain letters or fragments of reports addressed to the Devatdar or Governor of Syria, which profess to recount the writer's experiences.

It must be admitted that Dr. Richter at the outset exposed his theory unnecessarily to the destructive fire of criticism by the inference he drew from the evidence presented by the text, as to Leonardo having remained in the East for a period of at least two years and by his having in the first instance assumed, on the basis apparently of a single line which does not necessarily bear any personal significance, that Leonardo while in the East had embraced Mohammedanism. This supposition, however, was subsequently tacitly abandoned.

A sequence of time references, some of which have been revealed by research subsequently to the time when Richter wrote, establish Leonardo's presence in Florence and Milan at dates which must necessarily contract any period of absence within somewhat narrower limits than those which Richter assigned to it. There would, however, be nothing at all impossible in the supposition that Leonardo might have gone to the East, worked there for a time in the position indicated in the letters and returned within a less space of time than that indicated by Richter as the necessary minimum. Transit in those days was fairly rapid and the distances involved were not great. Only fifteen days elapsed between the date of the surrender of the Pazzi conspirator, Bernardo Bandini, at Constantinople to the emissary of the Medici

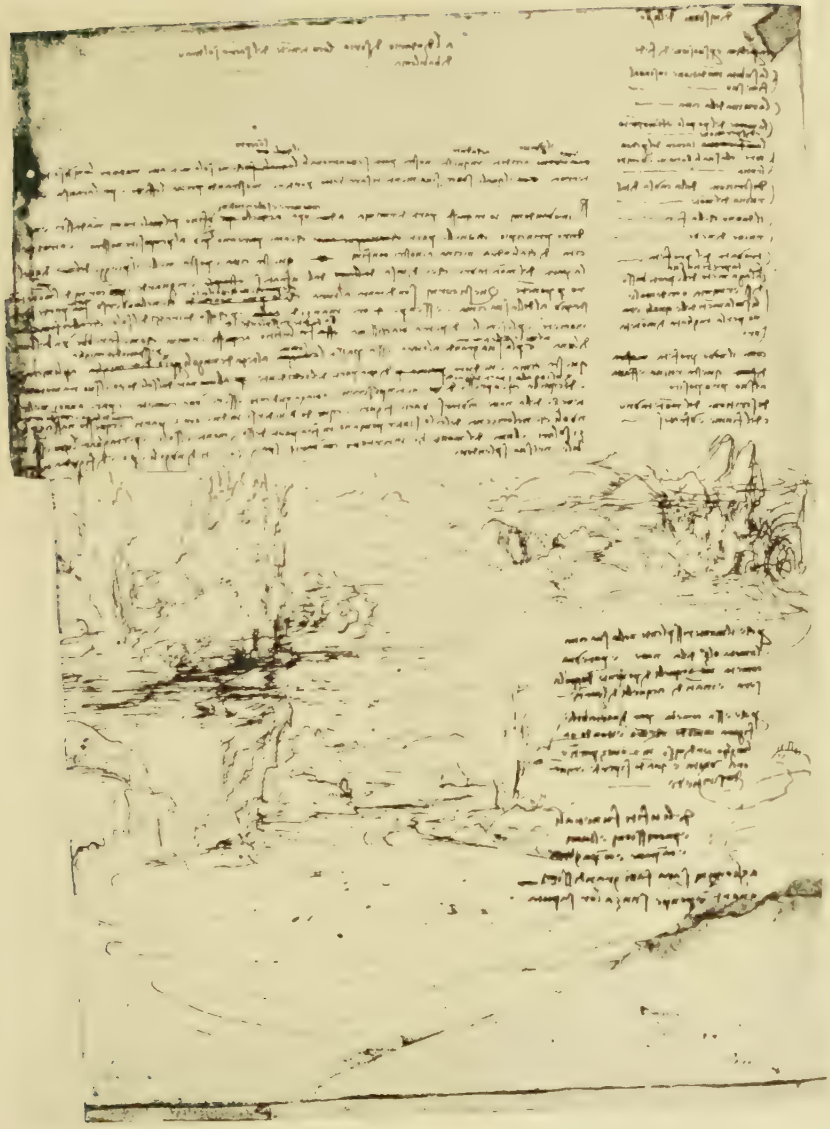
and that on which Leonardo made a sketch of his lifeless body as it hung on the wall of the Bargello at Florence.

There is more than one hiatus in the documented life of Leonardo before the date of his arrival in Milan of more than sufficient length to render it hazardous to attempt to deny the possibility of such a period of service on chronological grounds. We really know very little of the circumstances of Leonardo's life up to the age of thirty. It is at any rate certain that he did not receive a sufficient number of commissions in Florence to cause his time to be continuously occupied. We know from the evidence of all the early biographies that his projected activities were widespread, and that his spirit was always preparing for new flights. We are led to infer as the only reasonable explanation of the draft of a letter on a page of the Codice Atlantico that he solicited employment from Ludovic Sforza in Milan, primarily as a military engineer, though ready also to undertake work in many other capacities. We owe to the fortunate circumstance of the charter of appointment having been preserved among the papers of the Melzi family our knowledge of a fact unknown to all his biographers, but confirmed by numerous notes and memoranda in his manuscripts, that he held for a time a similar position in the Romagna in the service of Cæsar Borgia. His whole life is a record of wandering, in search primarily of the opportunity to carry out some of the projects which ambition was building in his brain – 'works of fame by which I could show to those who shall see them that I have been,' as he says in a fragment of a letter to Ludovic Sforza. There is, therefore, no inherent improbability in the supposition that in a mood of dissatisfaction at the smallness of opportunity for the exercise of his powers which presented itself in Florence he may either have made some such application to the Sultan as he afterwards made to the Sforza, or have taken a journey in order to seek for new opportunities, and as a result have found himself for a time in the position revealed in the letters in the Codice Atlantico. The matter

is entirely a question of evidence, and the evidence contained in these letters is the sole factor which should operate in determining their character. The consideration of other possible indications of travel contained in the manuscripts may, however, be fitly conjoined with it in order to ascertain what light, if any, they throw on the general question. With the exception of a somewhat vague and unconfirmed reference in the Anonimo Gaddiano to an earlier visit to France the early biographies do not mention any journey made by Leonardo beyond the confines of Italy previous to his going to Amboise, but their record is otherwise so incomplete as to rob the fact of much significance.

The first of these letters or drafts (Codice Atlantico, fol. 145v.a), inscribed, as its title states, 'to the Devatdar of Syria, lieutenant of the sacred Sultan of Babylon,' contains at the outset a promise to relate in due order, showing first the effect and then the cause of the recent disaster which has occurred in what Leonardo characterizes as 'our northern parts,' and which he is convinced will cause terror not only to the Devatdar but to the whole world, a phrase which, it may be observed, is less appropriate if the report was composed with the single purpose of being read by the Devatdar, than if it was intended for a wider public.

He then plunges *in medias res*: 'finding myself in this part of Armenia to carry into effect with love and care the work for which you sent me, and in order to make a beginning in the part which seemed to me to be most suitable to our purpose, I entered into the city of Calindra near to our frontiers, which is on the seaboard of the part of the Taurus Mountains divided from the Euphrates and having the peaks of the great Mount Taurus to the west.' The attempted exactitude in the description of the position of Calindra argues, according to Richter, that it was a place of no great importance and little known. He makes no attempt to identify it, but contents himself with remarking that it can hardly be the same as the seaport of Cilicia with a somewhat similar



FIRST PAGE OF 'THE ARMENIAN' LETTERS

name. Richter, however, as Douglas Freshfield has pointed out, in rendering 'spiaggie' as 'base' in place of its usual meaning 'sea coasts' or 'borders,' has neglected an obvious clue to identification, and Freshfield thinks it probable that the reference may be to the seaport of Cilicia, Celenderis, the mediæval Kelindreh. This locality is also referred to by Leonardo in a sentence in the Windsor Manuscripts in a manner which, if not actually suggestive of it, is entirely compatible with it being a personal reminiscence.

At the conclusion of a passage which contains an elaborate description of a temple of Venus he adds, 'from the coast – setting out from the coast of Cilicia towards the south you discover the beauty of the island of Cyprus,' and on the reverse of the same sheet he affirms the visibility of Cyprus from the southern shores of Cilicia.

The peaks of Mount Taurus are stated to be of such a height as to seem to touch the sky, and Leonardo commits himself to the statement that there is no part of the earth higher than its summit.

The passage, as Richter says, would seem to have been written before Leonardo went to Milan and had before his eyes the spectacle of Monte Rosa. He makes, however, an apparently exact observation as to the sun's rays striking the east side of the mountain four hours before day, and refers to its intense whiteness, which causes it to shine for the Armenians like bright moonlight in the midst of darkness, this being due to it being of limestone which, as Richter observes, is common in the Taurus Mountains.

The mountain, he states, by reason of its great height, outreaches the utmost level of the clouds for a space of four miles in a straight line. Its peak is seen in many parts of the west illuminated by the sun after its setting during a third part of the night. This apparently has been already observed by the Devatdar in the company of Leonardo, for he adds, 'it is this which with you we formerly in calm weather judged to be a comet,' and it seems in the darkness of the night to

change its form and to be divided into two or three parts, or to elongate or contract, this being caused by the action of clouds on the horizon which interpose between part of the mountain and the sun and cut off some of the solar rays.

This passage, in inception a report, develops with something of the discursiveness natural to Leonardo, whose interest was always ready to be evoked by all strange manifestations of nature. On the lower part of the same page of manuscript is a sketch of mountainous scenery, evidently intended to illustrate the text. To the right of the same page, by the side of the passage from which I have quoted, there are a series of short sentences under the heading 'the divisions of the book.' They contain apparently an outline of what it was intended that the report should consist of. Some refer to the coming of a preacher or prophet and his prophecies, and the destruction of a city through an inundation caused by an earthquake which has occasioned the fall of part of a mountain.

The last three of the divisions named are 'the inundation of the lower part of Western Armenia, the draining of which was by the cutting through the Taurus Mountains,' 'how the new prophet showed that this destruction would happen as he had foretold' – the reference being to Mahomet, according to Richter, who cites a confirmatory passage from the Koran – and a description of the Taurus Mountains and the river Euphrates. The last of these is treated of at some length in two passages on folio 145v.b of the Codice Atlantico entitled 'of the shape' and 'of the structure and size of the Taurus Mountains,' and across the lower half of the sheet covered in part by the text is a drawing of landscape of a mountainous nature. The first passage begins with a personal explanation, intended apparently to remove the misgivings of the Devatdar as to the diligence of his correspondent. *Mutatis mutandis* it might be an excerpt from a letter to Il Moro, in which Leonardo was exculpating himself for delay

in one of his great commissions. The reason of this delay is the inveterate one that he has been 'seeking out and diligently investigating the cause of so great and stupendous an effect.' 'And this could not be done without time.' There is such reiteration of excuse as the necessity of justifying himself before an arbitrary superior might well occasion. The Devatdar is not, he repeats, to be aggrieved at his delay in replying to his urgent request because the matters concerning which he has made inquiry are of such a nature that they cannot well be expressed without some lapse of time. If this is, as Professor Govi suggested, the writing of romance, it must be conceded that it abounds in singularly unromantic periods. So after these various exordiums he arrives at the *mise-en-scène* thus: 'I will pass over any description of the form of Asia Minor and the enumeration of the seas and lands which bound it because I know that the diligence and thoroughness of your own studies have not left you in ignorance of these matters, and I will go on to describe the true form of the Taurus Mountain, which is the cause of so stupendous and destructive a portent and which will serve to expedite our purpose.' There follows a reference to the information given him by the inhabitants of the shores of the Caspian as to the identity of this Mount Taurus with Mount Caucasus. The passage is very definite in its claim as to the information being obtained in this manner, but the substance of it is somewhat meagre when all is said: 'This Mount Taurus is that which with many others is said to be the ridge of Mount Caucasus, but wishing to be quite clear about it I desired to speak with some of the inhabitants of the shores of the Caspian, who give evidence that this must be the true Mount Caucasus and that although their mountains bear the same name these are higher, and this is confirmed by the fact that Caucasus in the Scythian language means supreme height; and in fact we have no knowledge of there being a mountain of so great a height either in the East or the West, and the proof of this is that the inhabitants of the countries in the

West see the rays of the sun illumining a large part of the summit for a fourth part of the longest night; and similarly with those countries which lie to the East.'

The passage which follows, entitled 'of the nature and size of Mount Taurus,' unlike that which precedes it, is entirely occupied with a description of natural phenomena. It tells of the variation in the length of its shadow in the middle of June, when the sun is in its meridian, and in the middle of December. The fact that the extent of this variation is expressed alternatively in number of days of travel, in June 'as far as the borders of Sarmatia twelve days off,' and in December 'as far as the Hyperborean mountains which are a month's journey towards the North, tends somewhat to reinforce the suggestion of Richter that these statements are founded on the information supplied by inhabitants of the Caspian shores, of which Leonardo has already spoken. So also with the statements as to the reason of the side of the mountain which faces the wind being always free from clouds and mists, and the fact of the thunderbolts caused by the clouds accumulating on the opposite side causing the rock there to be all riven and filled with huge débris. The description of the base has a simplicity suggestive of personal vision. The well-watered valleys, the air of affluence of the population, and the fertility of the soil, especially in the parts which face the south, are the features which a traveller would naturally observe. So also the description of the changes in the character of the vegetation in the various stages of the mountain's side up to the region of the eternal snow. The desolation of the upper parts of the mountain is told with a certain graphic power: – 'half-way one begins to find the air scorching and never to feel a breath of wind. Nothing can live there long; nothing is brought forth there except a few birds of prey which breed in the high fissures of Taurus and descend below the clouds to seek their prey upon the grassy slopes of the mountains. Here is all bare rock, that is from the clouds upwards; and the rock is

dazzling white. No one may climb to the high summit by reason of the rough and hazardous nature of the ascent.'

With these drafts of letters and despatches, in which, so far as can be discerned, the initial purpose has been left somewhat in abeyance, may also be considered two fragments of a letter on folio 214v.d of the Codice Atlantico. As these neither state to whom they are addressed nor make any mention of localities, the connection is a matter of inference. The nature of the contents, however – a great part of which might be summarized under three of the titles in the former passage known as 'the divisions of the book,' namely 'the destruction of the city,' 'the deaths and despair of the people,' and 'the avalanche' – places this connection beyond any reasonable doubt. Close as this connection is as regards subject matter, as Richter points out, the letter was apparently not addressed to the Devatdar like those previously referred to, and he assumes that it was written to some other patron and friend. From phrases in the letter it is clear that the person for whom it was intended was one on whom Leonardo stood on terms of considerable intimacy. He had already written to him many times: 'having often,' he says, 'by my letters made you acquainted with the things which have happened here, I feel I ought not to pass over in silence what has occurred within the last few days'; the second fragment opens in a warmer, more personal strain, 'having many times in my letters rejoiced with you over your prosperous fortunes, I know that now as a friend you will commiserate me upon the wretched condition in which I find myself.' The letter goes on to state that during the last few days the writer and the hapless country folk have been plunged in such distress, fear, peril and loss that they have envied the dead. Never, he thinks, since the elements formed the world have their might and fury combined to work such havoc to man as they have experienced within the space of ten hours. They were assailed first by the might and fury of the winds, then great ava-

lanches filled up the valleys and destroyed a great part of the city, and floods submerged the lower part of it. After this came sudden rain or ruinous tempest, and water, sand, mud, and stones fell upon them mingled with roots and stumps and branches of trees and all manner of things.

Finally, he continues, there has followed a great fire which has devastated the country and has not yet ceased. The few who survive are in such dejection and terror that like dullards they scarce dare to speak one to another, but abandoning all their work they stay crouching together in some of the ruins of the churches, men and women mingled, small and great, like herds of goats. Their neighbours out of pity have helped them with food, although they were formerly their enemies, and but for this they would have died of hunger. All these evils are as nothing to those which are promised them within a short time. The fragment ends as it began on the note of friendship: 'I know that as a friend you will grieve over my misfortunes just as I in former letters have rejoiced at your prosperity.'

This letter is ostensibly a description of the effects of a great convulsion of nature, presumably an earthquake, which has occurred in a mountainous region, destroying the greater part of a city and causing widespread inundations. Three of the circumstances described in it correspond to headings or 'divisions of the book' in what purports to be a scheme for a projected report by Leonardo to the Devatdar of Syria. The inference is irresistible that whatever interpretation may be placed upon the drafts which form ostensibly the substance of this report, this letter must be looked upon as relating to the same circumstances. As such it adds materially to the information which they convey. If we regard them as an exercise of the imaginative faculty, it shows the lines along which it was intended that action should proceed. If we accept them as statements of fact, it would supply conclusive reasons why Leonardo found himself unable to attempt to discharge the duties attached to his office and why conse-

quently his stay in the regions of Armenia was of no long duration.

There remains, however, the question, what conclusion can be drawn as to the character of the drafts of letters and reports which have been thus summarized? Are they or are they not a record of experience, and if so, is the experience that of Leonardo himself, or is he indebted for his facts to some mediæval or contemporary traveller? Since Richter first drew attention to the existence of these passages the trend of critical opinion has been distinctly adverse to his conclusions. The alternative theory was propounded by Professor Govi, who suggested that the sources from which Leonardo derived these passages were the accounts of some contemporary geographer or traveller, and that starting from these he thought of making a book which was to be a kind of romance in letters, the scene of which was to be laid in Asia Minor. Richter has admitted that this solution is under the circumstances the easiest way of dealing with the question. But though it avoids some difficulties it creates others of considerable magnitude. In the complete absence of information as to the identity of the traveller or geographer from whom Leonardo derived his facts the theory rests on an insubstantial foundation. The subject matter of the letters is so occupied with the description of natural phenomena as to exclude altogether the accustomed marrow of romance, and the drawings of mountainous scenery which apparently interpret the text, while not necessarily incompatible with the romance theory, do not help it.

The prefatory passages in which the writer in exculpating himself from the charge of idleness pleads the necessity of spending time in seeking out causes has all the directness of personal utterance such as is seen in the fragments of letters to Il Moro, but this also is not necessarily inconsistent with Govi's theory. Two other critics demand notice by reason of the distinctness of their point of view. Douglas Freshfield, writing primarily as a geographer, has disputed Rich-

ter's conclusions as to the letters. The sketch map of the sources of the Tigris and Euphrates which Leonardo made to illustrate them he characterizes as 'very rough but, for the time, accurate,' but he considers that the names and descriptions given in the map and the letters are not such as would have been used by a mediæval traveller or understood by any oriental official, five of the names occurring in the map being classical forms taken from Ptolemy.

This reasoning is rather difficult to follow if the traveller in question were Leonardo, as Freshfield himself refers to the frequency with which references to Ptolemy are found in Leonardo's manuscripts. He also suggests that the story about the Caucasus shining by night is derived from Aristotle's *Meteorologica*, where the statement occurs, this work also being one of those referred to by Leonardo. Allowing, however, all weight to his contention that the knowledge of the country displayed in the letters is not such as a traveller would gain, that it is literary knowledge, the Taurus and Caucasus being confused as they are in ancient authors and the stories told of them being old-world fables, we must not altogether lose sight of the fact that the sources of knowledge actually open to a mediæval traveller must necessarily have been circumscribed, and that book knowledge as to names and much else might be, and probably was, dominant in the memory. His conclusions tally with those of Govi that the letters are a flight of fancy, but he suggests that they were composed to stimulate the imagination for an artistic work, and refers to other compositions which show the fascination that storm and tempest and the unusual in nature possessed for Leonardo. As he points out Richter only cites two drawings among Leonardo's sketches of an undoubtedly Eastern character: one of camels made to illustrate a note on the means of crossing rivers, and another of three Armenian heads. But to say as he does that 'it is inconceivable that the painter if he ever lived in the East should not have made

hundreds of drawings of the new and strange things met with there' seems to be a somewhat too arbitrary assignment of his time.

Gustavo Uzielli in his monumental *Ricerche intorno a L. da V.* (Turin, 1896) cites documentary evidence which proves Leonardo's presence in Florence in 1472, 1476, 1478 and 1481, and in Milan in all probability in 1483 as well as in 1487, thus restricting considerably any of the periods mentioned by Richter as possible dates for his theory. He considers the journey to the East improbable, although he admits that Leonardo's maps show a knowledge of the locality. While he is disposed to allow that he may have been indebted to some traveller, he does not think it probable that his intention was to write a romance, but that he desired to have documents as exact as possible in order to compile memoirs of travel which though imaginary should be historical. The fantastic romance of which Mandeville's *Travels* – a copy of which was in the possession of Leonardo – serves as a type Uzielli consider altogether alien to the nature of Leonardo's genius. The question has been reviewed exhaustively in a monograph by Carl Brun, and his conclusions tally with those of Govi. Girolamo Calvi, in his recent work on the Manuscripts of Leonardo, holds that the type of script of the three pages of the Codice Atlantico which contain the material in question is such as can hardly be assigned to a date earlier than 1494. Chronology by consideration of script is not by any means infallible, but in so far as it is an exact science Calvi is one of its most convincing exponents whose conclusions must always merit careful consideration. His contention in this case would of itself, if admitted, disprove Richter's suggestion, for from this date onwards the time references crowd too thickly in the record of Leonardo's life to render any such absence a possibility. The letters contain a mention of a prophet and also of his prophecies, and in this connection Calvi has made the interesting suggestion that the letters should be regarded as connected with and perhaps

as serving as a kind of introduction to the important section of Leonardo's imaginative writings known as 'the prophecies,' one of which concerning funeral rites and ceremonies occurs on the same page as the letter addressed to the Devatdar and 'the divisions of the book.' This would link them with authentic work and so avoid one at any rate of the difficulties in the 'romance' theory, but the contents of the letters as a whole do not seem to strengthen the assumption that they were intended in any exact sense to serve as an introduction to the collection of terse epigrammatic utterances in which the vigour and sardonic humour of Leonardo's personality finds so unique a medium of expression.

The letters throughout are couched in quite a different vein, being an exact description of the manifestations of natural forces told in simple narrative. The drawings around which a part of the text is grouped in interpretative comment show that he intended primarily to explain the occurrence of certain physical phenomena, and by description and sketch to render an account with more exactitude. To believe it a transcript of the narrative of a traveller which had impressed him by its picturesqueness would meet the difficulties as well if not better than any other suggested solution, but of this there is no confirmatory evidence, and it is controverted by the claim of the letters. Richter's interpretation of them is now, as Calvi says, discredited (smontata). So much is this the case that the latter does not think it necessary to follow him in his consideration of the evidence as to places in the East contained in other passages of Leonardo's manuscripts. Most of these may be found under the heading 'the Levant' in the section of Leonardo's writings as grouped in Richter's work under the title 'Topographical Notes.'

This section fully bears out the statement that Leonardo displays frequently in his writings considerable knowledge of countries he had certainly never visited. This would fol-

low as a natural result from his whole scheme of thought and conduct. He was always avid for this knowledge. He left no possible avenue untried. He says in the Codice Atlantico (folio 373v.a): 'the knowledge of past time and of the position of earth is the adornment and the food of human minds.' With result that the learning of antiquity and of his contemporaries, the talk of travellers, all were laid under tribute to add to the sum of his researches in the earth's history. 'The imagining of things that are past,' 'post-imagining,' as he terms it in a sentence in the Windsor Manuscripts, is the chosen bourn of thought. So following on the lines which his own researches in geology among the rocks and river cuttings in the regions of the Arno had revealed he envisaged in a passage of sustained descriptive power at the commencement of the Leicester Manuscript a time when, as is shown by the fact of shells and bones of great fishes being found in the sides of the mountains, the waters of the Black Sea covered much of what is now the valley of the Danube and much else of Eastern Europe and Asia Minor. He there mentions the spurs of Mount Taurus and also Mount Caucasus, and again on folio 31a of the same manuscript Mount Taurus and the mountains of Armenia.

The manuscript in which these passages occur was written from twenty to thirty years after what would be the latest possible date for the composition of the Armenian letters if it were admitted that they were records of the writer's own experiences. There is, however, no word in either passage which can be construed as indicating ány first-hand knowledge, or anything which would serve to indicate that any record of these scenes was graven upon the tablets of memory.

In the Leonardesque conception of cosmography a most prominent part is played by rivers. Their courses formed for him vistas in which the natural history of the earth stood revealed. He says in a passage in the Codice Atlantico, where he is describing changes in the earth's surface: 'Every valley

has been made by its own river, and the proportion between rivers is the same as that between valleys.' He then continues: 'The greatest river in our world is the Mediterranean river, which moves from the sources of the Nile to the Western ocean.' This conception and the desire to go back to origins may be in part the reason for the strange fascination which the Nile and its adjoining territories possessed for him, as shown by the frequency of the references in the manuscripts.

Many of these are obviously derived from literary sources, but a note in Manuscript B of the Institut (folio 61v.), which may be dated, in the opinion of Calvi, as belonging to the early years of Leonardo's residence in Milan, might conceivably, from the phraseology, be an attempt to memorize an incident witnessed on an occasion during travel. It runs as follows: 'the Egyptians, the Ethiopians and the Arabs when crossing the Nile are accustomed to attach two bags to the sides of the bodies of their camels, that is wine-skins of the shape shown underneath.' There then follows a sketch of a bag, with the note, 'in these four rings of the net the baggage camels place their feet.' The sketch below represents five camels thus equipped crossing a river, the last with a rider. It seems volatile as thought itself, with an effortless sureness of line which finds its parallel in some of Rembrandt's drawings. The attempt, however, to arrive at the circumstances under which this note was written must take into account the whole contents of the section of the manuscript in which it occurs. It is one of a series of pages in Manuscript B (folios 61r., 61v., 62r., 62v.), which record the researches which Leonardo made as a military engineer. He has there collected information and made sketches of devices in use among various different peoples, primarily for the purpose of enabling soldiers on the march to transport themselves and their baggage across rivers, and for this purpose he lays under contribution, not only the habits of the Egyptians, Ethiopians and Arabs when crossing the Nile, in the passage already quoted,

but also analogous usages practised by Assyrians, Euboeans and others. In one of the latter the information is stated to have been derived from Lucan, and it may therefore be concluded that the facts in each case have been derived from literary sources.

We seem, however, to touch what may possibly prove to be more definite ground in the two references to the island of Rhodes. On the cover of Manuscript L of the Institut, which, as time references show, was written in the year 1502, is a note, 'Rhodes has in it five thousand houses.' Where and when Leonardo obtained this knowledge is a matter in which there is nothing to sustain conjecture. The second reference occurs on folio 10b of the Leicester Manuscript, where it is stated that in eighty-nine there was an earthquake in the sea of Atalia near Rhodes which caused the bed of the sea to open, and that such a torrent of water poured through this opening that it was more than three hours before the sea returned to its former level. On the assumption, which seems an entirely reasonable one, that by the year 'eighty-nine' Leonardo meant fourteen hundred and eighty-nine Richter directs attention to the evidence in an unpublished Arabic manuscript at Paris of the occurrence of a terrible earthquake in the year 867 of the Mohammedan Era, which corresponds to the year 1489.

As before, there is nothing to sustain conjecture as to how Leonardo acquired this knowledge. On folio 66a of Manuscript L of the Institut there is a note as to the dimensions of the bridge of Pera at Constantinople: '40 braccia wide, 70 braccia high above the water, 600 braccia long, that is 400 over the sea and 200 on the land, thus making its own supports.' With it are two sketches of a bridge as seen in ground plan and horizontally.

The date of the manuscript in which this note occurs is 1502, and in this same year a Turkish embassy visited Cæsar Borgia. It is possible that Leonardo, who was then in his service, may have received the requisite particulars on this

occasion and then made the sketch. Four years later the Sultan employed certain Franciscan monks as his envoys to try to induce Michelangelo to undertake the construction of the bridge at Pera, this being known from the testimony both of Condivi and Vasari. There is therefore nothing improbable in the supposition that he made overtures to Leonardo four years before with the same purpose. The note affords no reason for supposing that Leonardo ever visited Constantinople.

Another memorandum in the Codice Atlantico (folio 260r.a) is 'to write to Bartolomeo the Turk concerning the flow and ebb of the Black Sea and (to ask) whether he knows if there is a similar flow and ebb in the Hyrcanean or Caspian Sea.' From the phraseology of the note it might be that the writer had knowledge himself of the conditions which existed in the first case and wished to confirm this, and also to make inquiries as to the tide in the Caspian; but it might also have been that he had reason to believe that Bartolomeo the Turk would be able to give him the information he required in the one case and not in the other.

Two passages in the Windsor Manuscripts (R. 1103–1104) stand in a somewhat different category. As a note at the end of the first and as the opening words of the second serve to show they are associated in the mind of their writer with a journey taken or contemplated from Asia Minor to Cyprus. Each is an ornate example of Leonardo's prose. In the first he builds up the architectural effect intended by deft sure touches, with arrangement of detail somewhat after the manner he enjoins upon painters. In the second a scene viewed or imagined serves as the occasion for a rhapsody sustained with fervour and lyric beauty of description. The first bears the title 'for the shrine of Venus.'

'You should make steps on four sides by which to ascend to a plateau formed by nature on the summit of a rock; and

let this rock be hollowed out, and supported with pillars in front, and pierced beneath by a great portico, wherein water should be falling into various basins of granite and porphyry and serpentine, within recesses shaped like a half-circle; and let the water in these be continually flowing over; and facing this portico towards the north, let there be a lake with a small island in the centre, and on this have a thick and shady wood. Let the water at the top of the pillars be poured down into vases standing at their bases, and from these let there be flowing tiny rivulets.

'From the coast. – Setting out from the coast of Cilicia towards the south, you discover the beauty of the island of Cyprus, which . . .'

The concluding sentence, separated from the rest by two architectural drawings and a sketch of Neptune, points the reference suggested by the title by reason of the fabled connection of the island with the goddess.

The sentence is resumed on the reverse of the page:

'From the southern seaboard of Cilicia may be seen to the south the beautiful island of Cyprus, which was the realm of the goddess Venus; and many there have been who, impelled by her loveliness, have had their ships and rigging broken upon the rocks which lie amidst the seething waves. Here the beauty of some pleasant hill invites the wandering mariners to take their ease among its flowery verdure, where the zephyrs continually come and go, filling with sweet odours the island and the encompassing sea. Alas! How many ships have foundered there! How many vessels have been broken upon these rocks! Here might be seen an innumerable host of ships: some broken in pieces and half buried in sand; here is visible the poop of one, and there a prow; here a keel, and there a rib; and it seems like a day of judgment when there shall be a resurrection of dead ships, so great is the mass that covers the whole northern shore.

There the northern winds resounding make strange and fearful noises.'

With these passages may also be considered a note on folio 77v. of Manuscript L, which by reason of the subject nature is placed by Richter among the passages which have to do with the art of painting in that it illustrates Leonardo's theory of 'the perspective of disappearance' (prospettiva de' perdimenti), but which as professing to relate a personal experience has also possibly a biographical significance. 'When I was in a position on the sea,' he says, 'at an equal distance from the shore and the mountains, the distance from the shore seemed to be much greater than that from the mountain.'

The note is accompanied by a slight sketch of a ship midway between two shores, proceeding from the mountainous shore *c b* to that marked *a*, which is by comparison low. The number *10* which appears in the middle of the spaces of water between the ship and either shore may be assumed to be a measurement of distance. If it were intended for ten leagues the space between the two shores between which the ship is travelling would be approximately sixty miles.

The date of the manuscript in which the note occurs is shown to be 1502, from various references in it of that date to places visited by Leonardo while travelling in Romagna. The note differs from all these in that it definitely refers to the incident as having occurred at some period of time already past. (Quando io fussi in un sito di mare.) If we accept the note as being, as it professes, a record of personal experience, we have to consider the question of what may have been the occasion or occasions in Leonardo's life previous to the year 1502 when such an experience could have befallen him. His movements as established by documentary record and the testimony of his biographers had lain approximately within a triangle the three points of which

were at Florence, Milan, and Venice. There is some evidence which points to his having visited Genoa, and it may be assumed that when at Florence he came to know Pisa and the mouth of the Arno. Neither these places, however, nor Venice offer any base on which to found a conjecture agreeing with the circumstances detailed in the note and sketch as to a voyage from a steep mountainous shore to a lower one both of which were visible at the same time. We must therefore if we accept the incident as a personal record – and this is what it professes to be – conclude that it occurred on some occasion of travel not recorded by the biographers. Let us consider this in conjunction with the letters descriptive of Armenia and the passages about Cyprus. There are the three passages in three different manuscripts. Two of them strike an entirely personal note: 'finding myself in these parts of Armenia . . . I entered into the city of Calindra,' and 'when I was in a position on the sea at an equal distance between two shores.' In the third the personal note is hardly less unmistakable, viz.: 'starting from the coast of Cilicia towards the south you discover the beauties of the island of Cyprus.' This statement is obviously from the manner of expression founded on experience, either the writer's own or else imparted to him. But the writer himself in the Armenian letters speaks of having been at Calindra, and the identity of this city with Khelindreh (the classical Celenderis, described by Strabo as 'a city with a harbour') is admitted by Freshfield, and was not perceived by Richter merely because by not translating 'spiaggie' in its usual sense of seashores he failed to locate it. The mediæval port Khelindreh was the usual port from which to embark from Cilicia to Cyprus, being the nearest port on the mainland, and Cyprus lies in a southerly direction. Pliny gives the distance as fifty miles. If we interpret the figures *10* in Leonardo's sketch of the ship as representing ten leagues, the whole distance would correspond very closely with the probable length of a journey from Khelindreh to a port in Cyprus if, as may be as-

sumed, the voyage skirted the inhospitable northern shore and terminated after rounding the cape on its eastern or western extremity. When such a journey was half completed the two coasts would be distinctly visible at the same time. From Capo Sant' Andrea, round which a ship would sail if bound for the port of Famagosta to the mainland, is just over fifty miles. The northern coast of Cyprus is precipitous: the hills rise to a height of up to 3,000 feet, but this elevation would seem but slight when it was seen from half-way across the strait by comparison with the range of the Taurus Mountains, which rise to three times their height.

The island of Rhodes, by reason of its geographical position, is on the eastern highway. Tacitus mentions Titus' visit there before he reached Cyprus, 'coasting along Achaia and Asia, leaving the latter country to his left he made for the island of Rhodes' (Tac. *Hist.* II, 2).

If the Armenian letters were a record of fact Leonardo bound on the Eastern journey would have followed the same route. This might have afforded him the opportunity of acquiring the knowledge which led him to make a note of the number of houses in the island of Rhodes on the cover of Manuscript L – the same manuscript that contains the note as to being on the sea between two shores – and also the statement in the Leicester Manuscript as to the effects of an earthquake near Rhodes.

I would not press unduly the inferences that spring to mind from this correlation of passages. Coincidences always awaken conjecture. Some of these at any rate are light as gossamer and would break in the handling. They may, however, serve to show that the evidence of a journey in the East contained in the Armenian letters is not entirely unsupported, and the confirmatory evidence is not the less worthy of consideration because it is taken from Leonardo's own manuscripts. The contents of the Armenian letters may perhaps furnish a sufficient reason why, if the theory of the journey

were accepted, its duration might be considered a matter of months rather than of years, for they show a cause that would operate to prevent him from remaining in the post to which he had been appointed.

He had been, as he states, reproached with idleness for the time spent while making preliminary surveys to enable him to perform the duties of his office; then the tremendous landslip and the inundation that followed it, of which the letters give so graphic an account, would in all probability render it impossible, at any rate for a time, for him to commence to execute any plans he had prepared if, as is to be inferred from the current of the despatches, these were connected with some branch of civil engineering. There was therefore no sufficient inducement to remain. He was at Khelindreh, and that was the port for Cyprus; and so, as he says, 'setting out from the coast of Cilicia towards the south you discover the beauty of the island of Cyprus'; and such a journey would offer the opportunity to which he alluded in the note in Manuscript L, 'finding myself in a position on the sea between two shores, both of which were visible' – and his course would be as shown in the sketch, away from the more precipitous towards the lower shore, contemplating as he neared the journey's end the wreck-strewn northern shore ever inhospitable to mariners, and this spectacle and that of the site of a temple of Venus were scenes of which he afterwards wrote descriptions. Any attempt to give this letter 'a local habitation and a name' would be doomed to failure for lack of all topographical details and because the temples of Venus in Cyprus were many in number. He may have seen the ruins of a temple at Aphrodisium near the headland Daulos.

Strabo tells of one on a promontory on the north-east corner which may be identified with Capo Sant' Andreas, 'not to be approached or seen by women,' and another beyond Salamis above the promontory Pedalium, 'a hill rugged, lofty and table-shaped, sacred to Venus.' Most famous of all was

that at Old Paphos, and it was to this temple that the visit of Titus was paid, and he is said to have restored it out of gratitude for the advice of the oracle. Tacitus has described the temple, and his statement about no rain ever moistening the altars, though they stand in the open air, may perhaps serve to recall Leonardo's description of the rock hollowed out into a great portico and supported with pillars in front, but although there is an undoubted vein of similarity in the description it does no more than create a possibility.

Freshfield, though he characterized the sketch map which illustrates the Armenian letters as very rough but for the time accurate, urged that the names and descriptions in the letters were not such as would have been used by a mediæval traveller or understood by any oriental official, being in fact derived from literary sources. The supposed literary sources of the descriptions are unknown. It is, however, abundantly clear from references in the manuscripts that Leonardo studied the geography of the world from all available sources, literary and others. Is it natural to infer that he would immediately change nomenclature to which he had become accustomed by research as a result of travel? Might he not have continued to use the old names? Leonardo's chief source was Ptolemy and Ptolemy's works were not unknown in the East, and might conceivably have been studied by an oriental official.

The letters, moreover, are only drafts, and therefore would be subject to revision, but as a basis of official reports they are full of enigmas. The Devatdar on reading them would receive information about things he knew already, and about other things in which presumably he took no interest. He would not need Leonardo to tell him the height of an Armenian mountain. In the descriptions of natural phenomena he would find exact observations interspersed among others of considerable vagueness. Official reports, however, even when they proceed from experienced officials, reflect in part the personality of the writer, and Leonardo could

only be a novice. As such he would have wide, far-reaching plans, and it is safe to assume that he would expound them in his own way, caring nothing for precedent.

The letters do not afford evidence of his having actually performed official duties: the most that could be claimed for them is that they reveal him preparing to do so in his own inimitable fashion, 'showing first the effects and then the causes.' But for the existence of the superscription the real purport of the contents might not be apprehended, so little do they partake of the character of an official report. It is, however, only through the fact of the preservation in the Melzi archives of a copy of the letter of appointment that we know of his service under Cæsar Borgia. The notes in Manuscript L made during his tour of inspection in Romagna would of themselves fall far short of suggesting the nature of any official duties, and, as their silence on the subject shows, he might be absent from Florence for a sufficient period to undertake the duties of such an office without the fact being recorded by his early biographers. The first letter refers to protests by the Devatdar against the writer's continued inactivity, and Il Moro is credited with similar protests in contemporary record. Meanwhile Leonardo was making preparatory researches for his commissions after his manner. The thread of similarity is no less real because only in the one instance was the commission accomplished and wisdom openly justified of her children.

It may be thought possible to regard the letters as having been copied by Leonardo from the account of some mediæval traveller, thus admitting that they are founded on actual knowledge without assuming that Leonardo was himself in the East, but without some corroborative evidence – and none has yet come to light – this theory can hardly be held to solve any of the difficulties of the position.

The theory that Leonardo was trying his hand at a romance in letters descriptive of imaginary travels is open

to the grave objection that the contents of the letters do not seem to be couched in such a vein. They are too matter of fact, beginning as they do with excuses for the non-performance of official duties and proceeding with descriptions, first of natural scenery, then of extraordinary physical phenomena, these being recounted in the mood of the scientific observer. To regard the letters, as some have done, as a deliberate piece of mystification is to ignore equally their professed character. Leonardo could and did set out to mystify. The rebuses, the allegories, the prophecies, all show the workings of this side of his nature. We may see it very much in evidence in the Gulliver-like fantasy of the giant from the Libyan desert given in a letter to a correspondent, Benedetto, to whom he essays to give the news of things from the East (see Codice Atlantico, 311r.a). By contrast the Armenian letters are pieces of straightforward narrative. While the evidence available to determine their character falls short of what is sufficient for certitude, the most reasonable explanation of the letters is apparently to accept them as being, as they profess, a record of fact, and to assume therefore that Leonardo did pay a visit to the East and there held for a time an office somewhat analogous in its duties to some of the services which he is found expressing his readiness to discharge in the well-known draft of a letter to the Milanese Court; and to assume also that the great convulsion of nature which he there witnessed as recorded in the letters may perhaps supply the reason why the length of time during which he remained there was short, and why he need not necessarily have been absent from Italy for more than a period of from six to nine months, which space of time may be located between various dated records of his first Florentine period. It would follow then that the remark in his manuscripts about a voyage from Cilicia to Cyprus and the descriptions of scenes in that island, and also the reminiscence of the writer having been at sea in a position between two shores, may be remembered incidents connected with his

return from Asia Minor after relinquishing his office. This explanation has at any rate the merit that it gives each of the personal statements in these pieces of evidence from Leonardo's manuscripts its natural interpretation.

AVIATION

ROUND the base of the Campanile at Florence a series of bas-reliefs, designed by Giotto and executed in part by Andrea Pisano, form an epitome of human progress from the Creation in mastery over the elements and in fullness of intellectual life.

Leonardo has testified in a well-known passage in his manuscripts to the importance of the position of Giotto in the history of the art of Florence. We may suppose these reliefs, on which his eyes must have rested times without number during the period of his apprenticeship and youth in Florence, to have been the subject of careful study by him, and it is quite possible that from one of the series he may have derived his first conception of a mechanism for flight. The relief, which is one of those executed by Andrea Pisano, and has in it something of the dignity and repose of the Pisanesque tradition, represents Daedalus in the act of trying his wings, thus symbolizing man's conquest of the air. A note about it by Ruskin may serve to convey an impression of its artistic quality with a glimpse of practical purpose:

'The head superb, founded on Greek models; feathers of wings wrought with extreme care, but with no precision of arrangement or feeling. How far intentional in awkwardness I cannot say; but note the good mechanism of the whole plan, with strong standing-board for the feet.'

It may not be entirely fantastic to suppose that the study of this relief is perceptible in the treatment of the wings of the angel in the small panel of the Annunciation in the Louvre. Certainly the description 'feathers of wings wrought with extreme care, but with no precision of arrangement or feeling' would apply equally to the picture. This shows the artist's study of the structure of a bird's wing, in the rows of feathers and tufted plumage, the big feathers which end the wings, the lesser ones above them, the tufts of down that nestle beneath the shoulders. Yet the resultant impres-

sion is neither of precision nor decoration, as is often the case in the treatment of wings by the earlier Italian and Byzantine artists, but simply of strength. The wings seem almost to quiver with life and vigour of movement. Their use has been considered in the mind of the artist. By contrast with those in the somewhat similar version of the same subject in the Uffizi, they are of dimensions sufficient to support the figure of the angel.

But Leonardo's interest in the bas-relief of the Campanile was, not, it may be conjectured, primarily artistic. The myth of Daedalus is the expression of man's belief in his ultimate inheritance of the air, and he looked beyond the problem of its plastic representation to the thought itself, from the art of Giotto and Andrea Pisano to that of Daedalus the maker of wings.

In the opinion of Dr. Calvi (*I Manoscritti di L. da V.*), who bases his conclusions upon the probable date of some pages of the Codice Atlantico in which references occur, Leonardo commenced to occupy himself with the problem of flight at an early period, probably during the time of his first residence in Florence. A reference in Manuscript B, folio 74v., 'try this instrument over a lake and carry a large bladder bound to you so that if you fall you will not be drowned,' shows that at the time the passage was written his apparatus was already so far completed that he could think of experimenting with it. The date of the manuscript according to Dr. Calvi is 1489–90.

Only when in course of time things old in promise are established, and the long-fought battle has been won, does it become possible to estimate with some degree of exactitude the *rôle* of each precursor, and to ascertain how far he travelled along the road of the final advance. In the case of Leonardo considered as the pioneer of the modern science of aviation, the evidence is of a very concrete character, and it is possible to define very narrowly the character of his researches and the nature of his conclusions.

A sentence of Otto Lilienthal's, one of the greater names in the history of the science, who paid for his devotion with his life, expresses succinctly that measure of contempt which the practical inventor is apt to affect for the mere theorist, however much he may be indebted to his researches: 'to conceive of a flying machine is nothing, to construct one is something, but to make trial of it is everything.' That Leonardo put his knowledge of theory to the proof is to be inferred from the only reference to these researches which is to be found in contemporary record.

It occurs in the *De Subtilitate* of that somewhat empirical physician and philosopher Jerome Cardan, of whom it is told that he visited England and cast a horoscope for Edward the Sixth, in which he foretold long life for that monarch. It is after including the invention of flight in a list of excellent arts which are hidden that he continues: 'it has turned out badly for the two who have recently made trial of it: Leonardo da Vinci also attempted to fly, but he was not successful: he was an excellent painter.' The laconic antithesis suggests – almost summarizes – the attitude of contemporary criticism with regard to Leonardo's scientific and mechanical pursuits. The standpoint is the same as that of Vasari, who regarded them as deviations from those purposes which Leonardo alone could accomplish. One by one the mechanical and scientific problems to which a great part of Leonardo's creative power was devoted have been solved. He stands revealed as 'the forerunner.' But the debt of later investigators has been primarily to nature as was that of Leonardo.

His researches were not links in a chain. He foretold what others afterwards accomplished, and as it happened not infrequently he foretold what proved to be the right method of performance. In art, on the other hand, what Leonardo left tentative and fragmentary must ever be incomplete. Others may partake of his influence, but there is no renewal of the spirit; none can add to the substance

or use the crucible of his thought. His achievement in art consequently is something more intimate and more unique, and as such it outweighs the sum of his researches and discoveries, although these traversed the whole domain of nature. In the one he is a creator, in the other a student, and the records of his work as such are to be found only in the thousands of pages of his manuscripts. The researches which these contain in the science of flight are of themselves sufficient to reveal the unflagging zeal with which he devoted himself to the study of primary causes. Time references in the various manuscripts in which the notes about flight occur show that the researches were pursued over a period of more than thirty years. The earlier group of passages, namely those in Manuscript B and part of those in the Codice Atlantico, seem to connect naturally with the evidence of an actual attempt at flight in Milan in about 1492. Similarly those in Manuscript K and in the Codice *Sul Volo degli Uccelli* and part of those in the Codice Atlantico seem to be preparations which culminated in an attempt at Florence in about the year 1505, and, as references in Manuscript E show, he was still pursuing the problem when at Rome. The subject is treated on about 200 pages of the manuscripts. The material falls naturally into two groups, the first being a series of investigations of the laws which govern the power of flight as manifested in nature by birds and other winged creatures, the second consisting of deductions from these principles as to the construction of a mechanism which should be capable of sustaining and being worked by man. The interdependence of the two parts of the inquiry is stated with great succinctness in a passage in the Codice Atlantico (161r.a):

'A bird is an instrument working according to mathematical law, which instrument it is within the capacity of man to reproduce with all its movements, but not with a corresponding degree of strength, though it is deficient only

in the power of maintaining equilibrium. We may therefore say that such an instrument constructed by man is lacking in nothing except the life of the bird, and this life must needs be supplied from that of man.

'The life which resides in the bird's members will without doubt better conform to their needs than will that of man which is separated from them, and especially in the almost imperceptible movements which preserve equilibrium. But since we see that the bird is equipped for many obvious varieties of movements, we are able from this experience to deduce that the most rudimentary of these movements will be capable of being comprehended by man's understanding; and that he will to a great extent be able to provide against the destruction of that instrument of which he has himself become the living principle and the propeller.'

In thus defining the principles which should govern the adoption of these laws to a mechanism controlled by man he is expanding a thought expressed also by Roger Bacon when he wrote in the *Opus Majus*, 'machines also for flying may be made so that a man seated in the middle may turn round a certain mechanism by which artificial wings may beat the air flying like a bird.' The sentence follows immediately after those in which the great thirteenth-century thinker anticipates the course of discovery in the use of motive power for navigation and locomotion, of the telescope, of diving apparatus, and of bridges without piers or other supports. Is it altogether fantastic to suppose that this passage from the writings of the great English philosopher may have been one of the moving influences at work in the mind of Leonardo?

That Leonardo was acquainted with some of Bacon's writings is clearly to be inferred from his mention of his name in the British Museum Manuscript (Arundel 263, folio 71b). The sentence 'Roger Bacon done in print' (Rugiero Bacone fatto in istanpa) is something of an enigma,

since it seems to be a reference to the process of printing from a manuscript rather than to the existence of a printed version. Perhaps Leonardo was so impressed with the originality of some of Bacon's conceptions that his note expresses his desire. Except for one entry of somewhat doubtful accuracy in a list by the Franciscan Sbaraglia, there is no evidence of any of Bacon's works having been printed until the year 1541.

It is at any rate a curious coincidence that each of the discoveries adumbrated by Bacon in the passage quoted should have been made the subject of investigation by Leonardo.

In the analogy which, like Bacon, he draws from nature to the problem before him, the problem of flight, Leonardo has anticipated the attitude of modern research. With his words may be compared those of Captain Ferber: 'il nous faut apprendre le métier d'oiseau, comme l'enfant apprend à marcher, et même, ce qui paraître à beaucoup, extraordinaire, comme le jeune oiseau apprend à voler.'

The famous discovery by the brothers Montgolfier has tended to retard almost as much as to advance the progress of aeronautical discovery through the resultant difference of opinion as to whether the apparatus necessary for flight should be lighter or heavier than air. The solution has been reached along the lines indicated by Ferber and they are substantially those of Leonardo.

Flight is a natural phenomenon, and consequently its laws are to be deduced by observation of nature. In acting on this principle Leonardo followed the course marked out by Aristotle in the chapters on the flight of birds in the treatise 'on the method of progression of animals,' with which it is reasonable to suppose him to have been acquainted, The references to Aristotle in his manuscripts are more numerous than to any other classical writer, and a note in the Codice Atlantico allows us to infer that he had access to translations in manuscript of works which had not then been printed.

The list of books in the Codice Atlantico which are believed to have formed Leonardo's library includes the names of Pliny and Albertus Magnus, both of whom investigated the causes of birds' flight. They added, however, little if anything to the sum of Aristotle's researches, and Albertus Magnus is in a special sense his follower and translator. In this relation to Leonardo the three may be looked upon as a single influence which proceeds from 'il maestro di color che sanno.'

By contrast, however, with Aristotle's inquiry, which is limited to considering the rudimentary principles of structure and movement of wings and tail in birds, insects and fishes, the scope of Leonardo's investigations is almost encyclopædic. As a means to determine the exact conditions of flight, which is the movement of one substance within another, he will consider also such operations of nature as offer parallel principles, thus:

'In order to give the true science of the movement of birds in the air, it is necessary to give first the science of the winds, which we shall prove by means of the movement of the water; this science is in itself obvious to the senses, it will serve as a ladder to arrive at the knowledge of winged creatures in the air and the wind.' (E, 54v.)

And again:

'Of the bird's movement – in order to speak of this subject it is necessary that in the first book you treat of the nature of the resistance of the air; in the second the anatomy of the bird and of its feathers; in the third the action of these feathers in various of its movements; in the fourth the strength of the wings and tail without beating of wings, with the help of the wind to serve as guide in various movements.' (F. 41v.)

And again:

'Before writing about winged creatures, make a book

about how inanimate things descend through the air without wind, and another about their descent with the wind.' (F, 53v.)

Accordingly we find him considering the descent of a board of uniform thickness placed first horizontally and then slanting in the air; and he shows how of bodies of equal gravity that will show itself less heavy which extends in greater breadth, and how the heaviest part of a moving object will serve as a guide of its movement, and how the variation of shape of the front or rear portion will deflect its course.

In treating of the science of the winds he shows how the wind varies in power according to its altitude, as is proved by the fact that birds always fly low when the course of the wind is contrary. The movement of the wind is similar in all respects to that of the water. The rudder behind the ship is imitated from the tail of birds; and swimming upon the water teaches men how birds move upon the air. The hand of the swimmer strikes and rests itself upon the water and so causes his body to glide away in an opposite movement: so the wing of the bird does upon the air, for when two forces strike against each other that which is the more rapid always springs back.'

He also defines the resistance of the air, and shows that there is as much pressure exerted by a substance against the air as by the air against the substance; and he shows how the fact of a bird remaining motionless on its wings in the air is due to an equilibrium of forces; and how the air beneath the movable substance which descends in it is condensed and the air above it is rarefied. After establishing these principles, with others of movement and weight fundamental to his purpose, he addresses himself to the theme more narrowly. Another introductory passage serves to show the order of the work:

'I have divided the *Treatise on Birds* into four books, of which the first treats of their flight by beating their wings;

the second of flight without beating the wings and with the help of the wind; the third of flight in general, such as that of birds, bats, fishes, animals and insects; the last of the mechanism of this movement.' (K, 3r.)

The material which corresponds to these divisions is sufficient to render it comparatively simple to construct the treatise from the manuscripts. Each part is based upon many detailed observations as to the distinctive features of the flight of various birds and other winged creatures. There are notes of this kind about the thrush, the swallow, the lark, the eagle, the kite, the magpie, the dove, and the rook, as well as about butterflies, flies, and bats. That these observations were at first hand is shown conclusively by such a sentence as this:

'I have seen the sparrow and the lark fly upwards in a straight line, being in a level position; and this comes about because when the wing is raised with swift motion it remains pierced through (by the air).' (C.A., 160r.b.)

Or this note with diagram:

'See to-morrow morning whether the bird which wheels round coming against the wind *n* stays in the line *a b*, keeping the head in *b*, or whether it is in the line *c d*.' (C.A., 220r.a.)

So 'of the commencement of the flight of birds,' which must be in one of two ways:

'The one begins by their lowering themselves with their bodies to the ground, and then producing a leap into the air by extending very rapidly the legs which are folded up; at the end of this leap the wings have finished their expansion, and the birds immediately lower them rapidly towards the ground and rise the second stage, which is slanting like the first; and so continuing rapidly they rise to whatever height they please.'

The second method is when they drop down from a height:

'They then merely throw themselves forward, and at the same time open their wings above and in front, and in the course of their leap they drop the wings down and backward, and thus rowing they continue their slanting descent.

'Others throw themselves with their wings closed, and as they descend they open their wings, and when they have opened them they are checked, and then they close them and fall.' (G, 64r.)

So also the successive stages of the flight, either with or against the wind, soaring, tacking, flying in loops, curving, gliding, falling, alighting, are all described with a similar closeness of observation and precision of detail.

The manuscripts contain many drawings of birds and other winged creatures in the nature of diagrams subsidiary to and explanatory of the text. Some are of great beauty, for the hand of the artist will not be denied. Certain maze-like delineations of the curves of a bird's flight may serve to recall various *intrecciamenti* which he made as studies for the design on the ceiling of the Camera delle Asse in the Castle of Milan, and the design itself may perhaps owe something to his studies of birds' movements.

Flight is the movement through the air of a body which conquers the resistance of the air by means of wings, which are worked by the tendons or muscles of the chest and shoulders somewhat after the manner of levers. The line of this movement is regulated according to Leonardo by the position of the centre of gravity, by the position of the tail, and by the angle at which the planes of the different parts of the body stand to each other. He thus defines the nature of straight and curved movements:

'All bodies which have length, and which in moving through the air have their lateral extremities equally distant from the line of their centre of gravity, will make straight

movements . . . If the lateral extremities of the bodies which have length are at an unequal distance from the line of their centre of gravity, then the movement of the body will describe a curve in the air, and this curve will have its concave part on the side where the extremity of the body is more remote from the line of the centre of gravity.' (E, 35v.)

The same result is also brought about by lowering one side of the tail. The line of movement will then describe a curve which 'will have its concave side towards the side of the tail that is lowered, and the wing on that same side will be slower than the opposite wing in proportion as the bird's movement is more curved.' (E, 36r.)

Also 'the bird which takes longer strokes with one wing than with the other will proceed by a circular movement' (C.A., 220v.c.). Or one wing may be held at rest, and then the curve will be of the sharpest, because 'the bird beats its wings repeatedly on one side only when it wishes to turn round, while one wing is held stationary' (K, 7r.). If the movement of the wings is equal above and below the bird's centre of gravity, but the downward beat of the wings is more rapid than the upward beat, the line of the bird's movement will slant upwards; and conversely the slant will be downwards if the wings move more rapidly in rising than in falling.

The exact action of the wing when the bird is in flight without the help of the wind is thus defined:

'The bird drops half the wing downwards, and thrusts the other part towards the tip backwards; and the part which is moved down prevents the descent of the bird, and that which goes backwards drives the bird forward.' (K, 12v.)

The bird's power to increase the speed of its movement when descending is by pressing itself closer together in the wings and tail, because by the fourth law of gravity 'that heavy substance makes the most rapid descent which takes

STUDIES OF BIRDS IN FLIGHT WHEN FLYING AND CIRCLING

up a less space of air' (E, 37v.). Its speed is checked by the opening and lowering of the tail and the spreading out of the wings at the same time to their full extent.

The helms or projections on the shoulders of the wings are formed of very small hard feathers, and are 'provided by resourceful nature' to enable the bird when in rapid descent to turn from one direction to another without the slackening of movement which would be caused by the bending of the whole wing.

The tail when lowered equally will cause the bird to descend by a direct slanting movement; if it is more lowered on the right side the direct descent becomes curved and the bird moves towards the right side with a greater or less curve according to the extent to which the right point of the tail is lowered, and similarly with the left side; if the tail is raised equally a little above the level of the backbone of the bird the bird will rise up by a direct slanting movement; and if it raises the right point of the tail more than the left the movement will curve towards the right side, and if the left point of the tail is the more raised it will curve towards the left side.

The structure of the wing, convex on its upper surface and concave on the lower, is adapted to help the bird to sustain itself upon the air, because the air flies more readily from the stroke of the wing as it rises than as it falls, for then the fact that the air is enclosed within the concavity of the wing produces its condensation more speedily than its flight.

The extremities of the wing are of necessity flexible, because 'when the bird is in position to receive the percussion of the wind slantwise, the extreme part of the lower wing is considerably bent, and makes itself in the form of a foot upon which the weight of the bird is supported somewhat' (E, 53v.).

In thus treating of the structure of the bird's members and the natural law of their movements the scope of Leon-

ardo's investigation is the same as that pursued by Aristotle. But whereas in the one case this forms the limit of the inquiry, in the other the conclusions are modified by the consideration of natural causes, such as the action of the wind and the operation of the laws of gravity.

The atmosphere, either still or in motion, is the substance within which the body in flight has to make its movements, and the instinct of the bird enables it to make use of the movement of the wind to serve its own purposes.

In describing the workings of this instinct Leonardo shows how the wind serves as a wedge below or above the bird, for 'birds which rise on the wind in circles hold their wings very high, so that the wind may serve as a wedge to raise them up; similarly in their descent they lower their wings so that less air sustains them, and the wind may act as a wedge above them and drive them down' (K, 58v.).

He describes those circles in which birds rise by the help of the wind as being of two kinds, simple and complex:

'The simple comprise those in which, in their advancing movement, they travel above the flight of the wind, and at the end of it turn and face the direction of the wind, receiving its buffeting from beneath, and so finish the reverse movement against the wind.

'The complex movement by which birds rise is also circular, and consists of an advancing and reverse movement against the direction of the wind in a course which takes the form of a half-circle, and of an advancing and reverse movement which follows the course of the wind.' (C.A., 308r.b.)

These are merely notes for a projected treatise, fragmentary as such, and in selection seeming still more so. Leonardo is here a student of natural science, and as such his presentation of the connection between the phenomena of flight as seen in nature and the operation of natural laws is of direct and primary value. 'Nature,' he says, 'is full of infinite causes which were never set forth in experience.'

But in the mind of their presenter these facts are considered in relation to an ultimate problem. From the fact of the bird acquiring lightness by extending itself and spreading out its wings and tail, he deduces the principle that that heavy substance shows itself lightest which extends over the greatest space – and so to the problem:

'from this conclusion it may be inferred that the weight of a man can be supported in the air by means of a great circumference of wings' (E, 39r.).

The objections are put into the mouth of an imaginary opponent, who urges that the sinews and muscles of a bird are infinitely more powerful than those of a man:

'because all the girth of so many muscles and of the fleshy parts of the breast goes to aid and increase the movement of the wings, while the bone in the breast is all in one piece, and consequently affords the bird very great power, the wings also being all covered with a network of thick sinews and other very strong ligaments of gristle, and the skin being very thick with various muscles' (*Sul Volo*, etc., 17r.).

But Leonardo shows that this great strength gives the bird a reserve of power beyond what it generally makes use of in order to support itself on its wings, which enables it to fly very fast or very high or to bear in its talons a weight corresponding to its own weight. Man has not any such great reserve of power, but he possesses nevertheless an amount of strength which Leonardo estimates to be more than double that which is required by his own weight.

The first model took the form of a pair of large wings worked by means of the arms or arms and legs, and attached to the body by a band which passes underneath the arms. It was in such fashion that Andrea Pisano had represented the art of Daedalus on the bas-relief of the Campanile.

The type in nature which Leonardo selected to serve as a

model was the bat, 'because its membranes serve as an armour, or rather as a means of binding together the pieces of its armour, that is the framework of its wings' (*Sul Volo*, etc., 16r.). He admits that the wings of feathered creatures are more powerful in structure of bone and sinew, but attributes this to the fact that they are penetrable: that is, that the feathers are separated so that the air passes through them, whereas the bat is aided by its membrane, which is not penetrated by the air.

He has also shown that birds like the lark, which fly high with the rising of their wings, because these are then pierced through with air, have their feathers spread out more widely than birds of prey, which can only rise by a spiral or circular movement. He attempted, therefore, to combine both types by making the wing of the instrument like that of the lark as it rises and like that of the bat as it descends – or, as he calls it, 'a method by which the wing is full of holes as it rises and is closed up when it falls' (B, 73v.). This he did by attaching various shutters (*sportelli*) to the surface of the wing. The drawings of these, together with the notes in Manuscript B, render an exact description possible. A net connected the framework of the wing, to the canes of which the shutters were fastened along their length on the one side, and on the other side were attached to them by cords at either end. The shutters had rims of cane and were covered over with taffeta, which had either been well soaped or rubbed with starch to render it air-tight. As the wing rose the air would pass through the net and force open the shutter to the extent allowed by the cords. As the wing descended the air below it would drive the shutter up against the net and so close up the holes, and this would cause the wing to present a solid surface to the air beneath it. He considered that in proportion as the shutters were smaller they were more useful.

There is a certain natural sequence in the various drawings in the Codice Atlantico and Manuscript B in which the in-

strument or a part of it is reproduced, and this renders it possible to trace the general progress of the design. The first intention, apparently, was to construct wings which should be attached immediately to the body. This in the classification of instruments by M. Berget is the type known as *ornithoptères*. Then the necessity of bringing all the muscles of the different parts of the body into play caused all the machinery to become more complex, and as a greater amount of force was made available to move the wings it became possible for these to be constructed with a larger surface.

In the second type the instrument has something of the appearance of the body of a huge dragon-fly, tapering slightly towards the tail, and the framework of the wings arched above the head resembles antennæ. Within the body the aeronaut lies at full length, face downwards. His feet are in stirrups, which work the wings by means of cords, one of these causing them to fall and the other to rise. Round the neck is a leather band to which a cord is attached, described as 'a rudder which is fixed with a band to the head at the place of the neck' (B, 75v.). The position of the instrument he states to be such that the wings in descending drop partly downward and partly backward, that is towards the feet of the man. The necessity of increasing the power of control led him so to change the mechanism that the wings were lowered by the force of both feet at one and the same time. By this means the downward pressure becomes twice as great, and 'you are able to delay and to maintain yourself in equilibrium by lowering one wing more rapidly than the other according to necessity, as you see done by the kite and other birds' (B, 74v.).

The raising of the wings will then, he says, either be by the force of a spring, or by the hand, or by drawing the feet towards you, the last being the best method because then the hands are left free.

In a passage in *Sul Volo degli Uccelli* (folio 6) he says that a man in a flying machine should be free from the waist

downwards to be able to balance as in a boat, so that his centre of gravity may balance that of the machine.

With the various drawings of instruments are notes as to the materials of which the parts are to be constructed. Sometimes a word or sentence is written in the particular part itself, such as 'staff of green pine,' 'fustian,' 'taffeta,' 'try first with leaves of chancery,' which last may be interpreted to mean some form of parchment. Two parts of the covering of a wing are described, one as 'fustian stuck over with feathers,' the other 'starched taffeta,' 'and for the experiment,' he continues, 'you will use fine pasteboard' (B, 74v.).

The joints are to be of stout tanned leather bound with strong raw silk, and no iron clasps are to be used, because either these are soon broken at the joints, or else they become worn out.

The joints of the canes are to be padded with leather. The springs may be made of ox-horn, and for the purpose of a model quill pens may be used. As an alternative, the springs may be of steel wires of equal thickness, number and length. The staff is to be of stout canes, and it may be made as long as is necessary because it is made up of pieces. The cord is to be a strip of ox-hide, well greased, as also should be the bindings where it plays, or these may be smeared with soft soap. In order to lessen the risk of accident the cord should be double.

'For the wings you should make one cord to bear the strain and another more slack in the same place, so that if the one is strained and breaks, the other remains for the same purpose.' (H, 29v.)

The same forethought prompts a note that the machine should be tried over a lake, and that a long leather bottle should be carried in the girdle as a safeguard against drowning in case of a fall; and in describing another type of machine he says: 'try the actual instrument in the water so that if you fall you will not do yourself any harm' (B, 89r.).

The various notes and drawings which relate to what was probably the latest type of the machine are among the most difficult to interpret. The machinery, although more compact, has become more complicated, and an attempt to define the practical value of the parts of it is only possible to the practised student of mechanics. A drawing of a man (B, 79 v.) suspended by the waist, in an attitude as though swimming, immediately below the drum round which the cord is turned, is apparently a preliminary to this latest type; the note below it describes how it may be worked either with one pair of wings or with two, and refers to a ladder or ladders of light thin pine at the base. These ladders are found only in the latest type of the instrument, and Leonardo defines their use as serving the purpose of legs when it is desired to rise above a plain, thus rendering it possible to beat the wings. He mentions the instance of the martin, which cannot raise itself by flying when settled on the ground because it has short legs.

A sketch shows how after the ascent has been commenced the ladders are to be drawn up so as to lie flat against the bottom of the instrument. They are made with curved ends in order apparently to lessen the risk of their becoming fixed in the ground. Finally the position of the man is changed:

'I conclude that standing upright is more useful than lying flat on one's face, because the machine can never turn upside down, and moreover the habit created by long use requires it thus. And the rising and falling movement will proceed from the lowering and raising of the two legs, and this is of great force, and the hands remain free, and if one had to be flat on one's face the legs in the fastenings of the thighs would have great difficulty in supporting themselves; and the feet have the first shock when it alights.' (C.A., 276 v.b.)

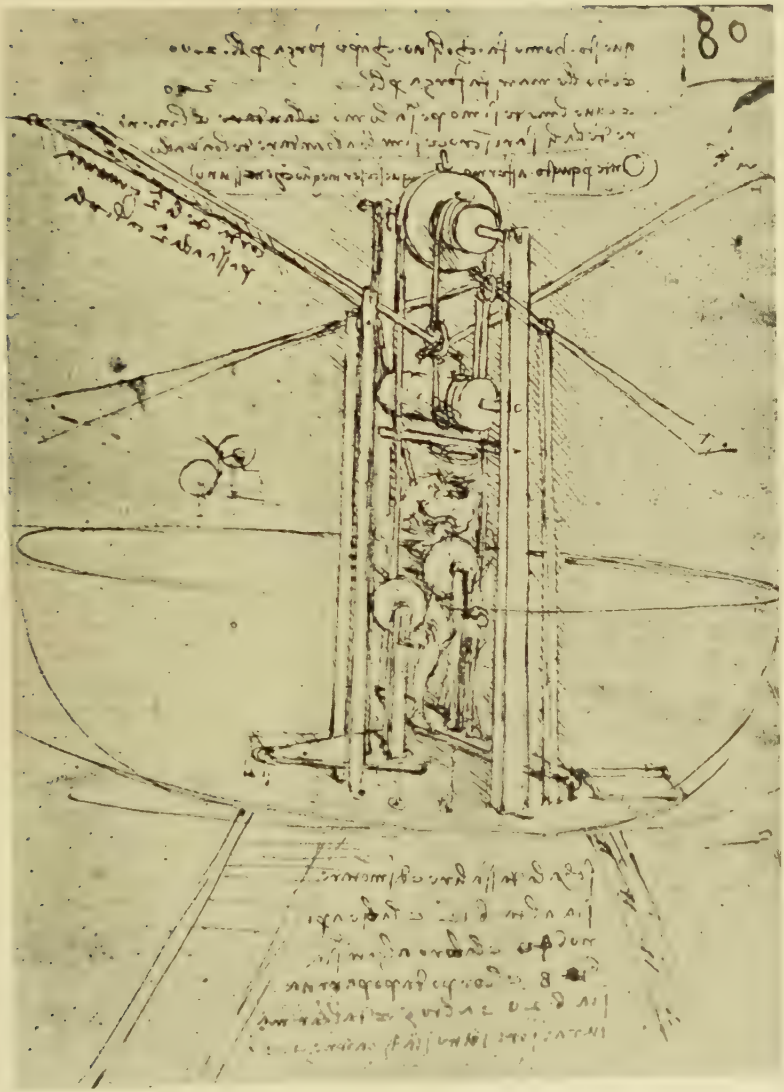
A drawing in Manuscript B (80r.) offers the most complete representation of this type of the instrument. In it the

figure of the man is seen standing on his feet, but bowed like Atlas under his burden. Above him are two pairs of wings, worked by cords and pulleys controlled by his head and limbs. He is placed between two posts which support a wheel above. Cords passed round it raise and lower the wings as the wheel moves. The posts go down to the base of a low basket-shaped car where there are pedals on which the man stands. These pedals are connected by cords with the wings. The car is resting on short ladders. Above the drawing is a note: 'the man exerts with his head a force equal to 200 pounds, and with his hands he exerts a force equal to 200 pounds, and this is the man's actual weight. The movement of the wings will be crosswise like the gait of a horse. So for this reason I maintain that this is better than any other.'

Another note below states the dimensions:

'Ladder to mount and descend: let it be 12 braccia (6 yards) high, and let the span of the wings be 40 braccia, and their elevation 8 braccia, and let the body from poop to prow be 20 braccia and 5 braccia in height, and let all the outer framework be of canes and linen.'

In its general outline the instrument has some resemblance to certain examples of the type known as *helicoptères*. But both in this and in the model of which the general structure has a somewhat greater resemblance to certain types of the modern aeroplane the only motive power to be discerned is derived directly from the strength of the human agent. The capacity of the instrument to overcome the resistance of the air is the capacity of his muscles to lift weights and to endure pressure transferred to this particular purpose by the use of suitable implements. Numerous passages in the manuscripts show that Leonardo doubted the adequacy of this power to accomplish more than at most short experimental flights. He contrasted it with that reserve of power possessed by the larger birds, and sought for a fresh source



STUDY OF FLYING MACHINE

of motive power to supplement or take the place of that exerted by man. It was in this that his researches were most in advance of his time.

In Manuscript B (folio 83v.) there is a drawing of a large screw constructed to revolve round a vertical axis. Accompanying notes tell of the materials and dimensions and reveal also the purpose which it was intended to serve:

'Let the outer extremity of the screw be of steel wire as thick as a cord, and from the circumference to the centre let it be 8 braccia.

'I find that if this instrument made with a screw be well made, that is to say made of linen of which the pores are stopped up with starch, and be turned swiftly the said screw will make its spiral in the air and it will rise high.

'Take the example of a wide and thin ruler whirled very rapidly in the air, you will see that your arm will be guided by the line of the edge of the flat surface. The framework of the above-mentioned linen should be of long stout cane.

'You may make a small model of pasteboard, of which the axis is formed of fine steel wire, bent by force, and as it is released it will turn the screw.'

Mons. Govi, who first called attention to the significance of these passages in a paper presented to the French Academy of Sciences (*Comptes Rendus*, 29 Août 1881), speaks of them as proving not only that Leonardo invented the screw propeller, but that he had considered its application to aerial navigation, and that he had constructed small paper models for this purpose which were set in motion by fine bent steel wires. The function of these springs in the machinery of the instrument is shown in two drawings of a flying machine in the Codice Atlantico (folio 314r.a). The one is a machine of the vertical type, the other a planimetric sketch of the base, within which is written the words *fondamento del moto*. These, together with an elaborate study of the mechanism of the right wing on folio 308r.a of the Codice Atlantico, repre-

sent the ultimate stage of the conception as found in the manuscripts, a stage separated from those which preceded it by the addition of a motive power. To this instrument the architect Luca Beltrami does not hesitate to apply the word aeroplane. Signor Beltrami's wide technical knowledge combined with his life of devotion to and enthusiasm for all that concerns Leonardo have contributed to cause his description of what is really a technical drawing to have such a clearness as approaches eloquence. The article (*Aeroplano di Leonardo*), first issued on the occasion of an aviation meeting at Brescia in 1909, was reprinted as appendix to a volume of papers entitled *Leonardo da Vinci, Conferenze Fiorentine*, issued in Milan in 1910. Would that some measure of its clearness might survive in my abbreviated rendering of the description!

'The apparatus consists of a rectangular horizontal plane, from the middle of the longer sides of which rise two vertical shafts made firm by two supports crossed diagonally. The vertical plane so formed is made rigid by two pairs of supports which connect the upper extremities of the shafts with the angles of the plane of the base. Two strong springs, each fastened at one end to the centre of one of the lesser sides of the horizontal plane, are bent round its sides by means of ropes, which by the interposition of pulleys are made to turn round a horizontal axle placed at the base of the two shafts; a cog-wheel situated in the centre of this axle allows the force stored up in the springs in tension to be able gradually to relax the rope, so causing the revolution of a second axle parallel to the first, and at the extremity of this are cranks for the purpose of moving the wings. These wings are poised at the upper extremities of the shafts, the right wing being fixed upon the left shaft and *vice versa*, so that the space between the two shafts, along which the motive power is exerted, forms the arm of a lever of which this power may avail itself. Each wing is moved by a vertical rod which is looped to the shaft by two rings, and gliding

through these it is able to be raised and lowered according as the fastening to one of the above-mentioned cranks is loose or tight. The lowering of the rod not only moves the arm of the lever of which the wing is a continuation, but displaces a pulley which turns the cords that correspond to the various loose sinews which together make up the subsidiary structure of the wing; consequently as the wing is raised and lowered these sinews and the surface of the wing are expanded and contracted.'

After thus explaining the construction of the parts of the instrument Signor Beltrami shows how these parts would be controlled by the human agent:

'The man who guided the machine had his place in the part of the horizontal plane enclosed within the two springs where the words '*fondamento del moto*' occur in the sketch. He had the cog-wheel in front of him, and could by a simple turn so adjust its revolution as to allow gradually and at his pleasure the ropes pressed by the springs to relax, and so cause the revolution of the axle where are the two cranks which communicate with the wings; as the slackening of the rope is quicker or slower, so the beating of the wings is more or less rapid, and so the flight is controlled.'

Although Leonardo never entered the Promised Land here surely he had a Pisgah-sight of it! In arriving at this stage he was separated from that of ultimate attainment only by the lack of knowledge of a light motor with power sufficient to move the mechanism, such as has only been rendered possible by the use of petrol. In the history of discovery, in the words of Lilienthal, 'the trial is everything.' It remains to consider the evidence of actual experiment. Except for the sentence in which Cardan mentioned an attempt at flight made by Leonardo and its ill success, the evidence consists entirely of passages in the manuscripts. The fact of the attempts apparently having been made under conditions of

secrecy enhances that degree of obscurity which seems inherent with Leonardo whenever the reference is of a personal nature. By contrast with the precision of the inquiry as to principles, the records of experiment in flight have something of the inconsequence of dream.

The earlier attempt apparently took place at Milan, the instrument having been made on the roof of a house in the Corte Vecchia where Leonardo lived during his first residence there, and where he constructed the model of the horse. The two references to it are in the Codice Atlantico (folio 361v.b): 'shut with a beam the room above and make the model large and high, and there will be a place on the roof above and it is more convenient in all respects than the loco d'Italia.' 'And,' he adds, 'if you stand on the roof at the side of the tower the workers on the dome (*tiburio*) will not see.' The meaning of this, according to Signor Beltrami, is that if the model stood behind the tower of St. Gothard it would not be exposed to the curiosity of the workmen employed on the dome of the Cathedral, and as these men were not at work there after the year 1500 the sentence affords evidence both as to the time and place of the attempt. Dr. Calvi has pointed out the probable significance of the outline map of a large part of Europe, which is on the same page of the manuscript, as forming in the dream of the conquest of the air which filled Leonardo's mind when he wrote these sentences the immense field which lay open to the skilled aviator.

A dated note in the Codice Atlantico (folio 318v.a), 'tomorrow morning, on the second of January 1496, I will make the leather for the straps and the trial,' may be interpreted as possibly a reference to an attempt to use a machine for flight, and if this be the case it would supply a possible date for the trial of the machine made on the roof of the house in the Corte Vecchia at Milan, since at the date mentioned the workmen would be engaged upon the *tiburio* or dome of the Cathedral.

Two somewhat enigmatical sentences on folio 18v. and on the cover of the Codice *Sul Volo degli Uccelli*, written in 1505, refer to an attempt at flight which was shortly to take place. The first of these, on the same page as a note of an apprentice Lorenzo having come to live with him on the fourteenth of April 1505, and so perhaps of the same date, is 'from the mountain which bears the name of the great bird, the famous bird will take its flight, and will fill the world with its great fame.' On the cover the statement recurs in a somewhat amplified form: 'the great bird will take its first flight upon the back of the great swan, filling the whole world with amazement, and filling all records with its fame; and it will bring eternal glory to the nest where it was born.'

The great or famous bird which is to take its first flight is the apparatus he had constructed. In the year 1505 Leonardo was at Fiesole. The mountain which bears the name of the great bird is identical with Monte Ceceri, the mountain to the south-west of Fiesole, the Italian word for swan being *cecero*, and when Leonardo speaks of the great bird as taking its first flight upon the back of the great swan, he is playing upon the double significance of the word.

The concluding part of the second of these two passages reveals as rarely a flood of emotion surging through the mind of the writer. In it, as perhaps unconsciously in that sketch map of southern Europe which accompanied the notes of the earlier attempt, the curtain is lifted for a moment and we get a glimpse of the exultation which Leonardo felt at the thought of what conceivably would happen when the conquest of the air had been won. Now that, not Europe alone, but the great expanse of ocean between two continents has been conquered by the aviator, and the air is still ringing with the news of Lindbergh's achievement, the words of Leonardo 'filling the whole world with amazement' have a strange prescience. If Leonardo's own attempt was made, as is believed, from one of the peaks of Monte Ceceri, it may

have been that the machine he made use of was constructed on the glider system without mechanical power. The trial apparently was made under circumstances of some publicity, and it may conceivably have been that of which Cardan chronicled the ill success.

On another page of the Codice Atlantico (214r.d) various notes reveal the scene and something of the method of another trial, and afford a glimpse of the precautions which he took in order to prevent the secrets of his discoveries from becoming known. The reference is apparently to small models such as those referred to in the passage in which the revolving screw is mentioned: 'Make a small one over the water, and try with the wind in a small space of water over some part of the Arno, with the wind natural, and then as you please, and twist the sail and the rudder. See to-morrow to all these chances and the copies, and then deface the originals and leave them at Florence, so that if you lose those which you carry with you you will not lose the invention.'

To these records of actual experiment may be added that of yet another page of the Codice Atlantico (311v.d). It contains three studies of artificial wings. Of these the most elaborate has a very strong frame, which would make it heavy to work. Its main support is curved like a collar-bone, and the lower part where it divides crosses the wing to a point about one-third distant from the shoulder to the tip. There is a considerable amount of detail, and the wire cords which cause the wing to open and shut are clearly indicated. Above it are the words 'for Gian Antonio di Mariolo,' and below 'not to make it with shutters (*sportelli*) but united.'

The most natural inference to be drawn from these notes is that they refer to the construction of a machine for flight as a commission for a patron whose name was Gian Antonio di Mariolo, who had moreover given Leonardo instructions that the wings should not be made with the self-adjusting shutters (*sportelli*) which occur in some of Leonardo's studies, but should be united, that is not such as to be penetrated by

the wind. The name Mariolo occurs also in the South Kensington Manuscript: 'the black Florentine of Messer Mariolo, a big horse, has a fine neck and a very fine head.' Dr. Verga in *Raccolta Vinciana X* and Dr. Calvi state, with reference to these two passages, that Giovanni Antonio di Mariolo and the Mariolo whose horse is referred to were the two brothers of that Mariolo de' Guiscardi who had a house near Leonardo's vineyard, his house and the road as being named after him being mentioned by Leonardo. The house was rebuilt at about this time, and Dr. Calvi thinks that Leonardo's ground plan of a large house with stabling for sixteen horses in the Codice Atlantico (folio 158r.a) was a commission for it. The two brothers took part in the tournaments held on the occasion of the marriage of Ludovic and Beatrice d'Este, the one had a fine charger, and the other apparently thought so seriously of taking up flying as to commission Leonardo to construct a machine.

¶ PART THREE

PAINTING

¶ PART THREE

PAINTING

§ 1

Two passages in Leonardo's treatise on painting, in which he seeks to define the painter's primary purpose, have a special significance for the biographer, inasmuch as apart from the didactic intention of the writer they seem to serve as a record of his own aims and practice. 'A good painter,' he says, 'has two chief objects to paint, man and the intention of his soul. The former is easy, the latter hard because he has to represent it by the attitudes and movements of the limbs. These should be learnt from the dumb whose movements are more natural than those of any other class of persons.' In this passage he defines the purpose from a philosophical standpoint and then, as was his custom, seeks for a practical avenue of approach. The endeavour by the medium of the limbs to express the intention of the soul is the underlying motive of that constant search for naturalness in expression which in the many drawings and preparatory studies for artistic commissions – some volatile as thought itself – attempts to fix the transient. Records show how constant was his search for types in which the expression of the emotions was unfettered by convention, and this was the case with the dumb, whose more than normal power to divine thoughts from gestures is the subject of a note in the Codice Atlantico. In the second of the passages from the treatise on painting the problem of the painter's purpose is stated in terms of technique, and again he passes abruptly from the statement to the consideration of means: 'The first object of a painter is to make a simple flat surface appear like a relief and some of its parts detached from the ground; he who excels all others in that part of the art deserves the highest praise. This perfection of the art depends on the correct distribution of lights and shades called chiaroscuro.'

In theory and doctrine, as this passage shows, he has passed far from the art tenets of the Florence of his early environment. Despite many felicities of line and colour progress there since the time of Masaccio had been mainly in naturalism along the lines of scientific study of structure and organism and of the laws of linear perspective. Those of aerial perspective had indeed found a notable exponent in the works of Piero de' Franceschi in Umbria and within the orbit of Florence at Arezzo, but with this notable exception what Meier Graefe has termed 'the victorious struggle of planes against lines continued with results more and more decisive' was a battle yet to be waged. Now that the combatants can be clearly discerned Leonardo is found ranged with the moderns. He might have subscribed to the dictum of Goya, who wrote 'in nature colour exists no more than line – there is only light and shade.' It would seem that the releasing of his spirit from such trammels as necessarily arose from contiguity to Florentine art traditions facilitated the process; but the unfinished Adoration of the Magi shows that he had already travelled far along the road before his departure from Florence. The fact of this composition being executed only in ground colour enhances the perception of the cardinal importance in the mind of the artist of the proper distribution of lights and shades. 'It requires,' he says in the treatise on painting, 'much more observation and study to arrive at perfection in the shadowing of a picture than in merely drawing the lines of it.'

An example of the continuous growth of the process in his art after his removal to Milan is furnished by the two versions of the Virgin of the Rocks. In that in the National Gallery, which is undoubtedly the later of the two, there is greater unity in the disposition of the light, which is so pervading as to bring to mind the words of Taine that 'the chief person in a picture is the light in which everything is bathed.' There is more virility of line, richer diversity of incident in the earlier version in the Louvre, but it is the

picture in the National Gallery which approaches most nearly to the standard set in the precept in the treatise on painting 'that your light and shade blend without strokes and borders, looking like smoke.' So subtly is this already rendered in the panel of the Adoration, so perfectly the treatment there exemplifies Fromentin's definition of chiaroscuro as the art of making atmosphere visible and painting objects in an envelope of air, that the Paris Virgin of the Rocks, though painted presumably after his removal to Milan, seems by contrast closer to Florentine traditions. A long series of drawings attest the stages of the growth of the conception, the composition of the central group being traceable to a sketch in silverpoint for an Adoration of the Shepherds which belongs to the earliest period of his work. The convergent action of the various attendant figures forms the subject of a sequence of studies rich in variety of motive. Except the Last Supper, the first sketch for which occurs on one of these sheets, no other of his compositions underwent so long a period of gestation. At its commencement his art retained something of the timidity and *naïveté* visible in the little panel of the Annunciation in the Louvre, which lingers in the ingenuous figure of the Virgin in the Gallichon drawing where there is the intimate, almost *genre* touch, which characterizes the Florentine treatment of the subject as pent within walls.

In the search for the maximum freedom of light and movement he finally moved the scene into an open space, placing a bank with laurel and palm in the middle distance, behind which a terrace and porticoes are all that he has retained of the earlier architecture. There the Madonna sits, bending joyously virginal and lissom, strong and radiant, and in the curves and supple contours of her figure, as in those of the Divine Child on her knee, there is something of that element of sculpture which has been said to exist in all good painting. The Magi in the near foreground are kneeling with their gifts, each carefully individualized in

attitude of deepest reverence; and all around, dimly seen, emerging out of the shadow, a mass of forms crouching, peering, kneeling, pressing forward, as though impelled by one irresistible impulse of wonder and reverence, each enduring triumphantly the test of the artist's own precept, 'you must give your figures such movement as shall be sufficient to show what is in the mind of those figures, else is your art unworthy of praise!' The freedom and naturalness of execution and the disposition of the lights and shadows show how far his art had already travelled on the way to its distinctive excellence: the long series of preparatory studies mark the stages of the journey. From a certain resemblance in treatment and drawing of the kneeling figure of the Virgin it would seem that one of the earliest of these – the study for an Adoration of the Shepherds in the Academy at Venice – is practically contemporary with the little panel of the Annunciation in the Louvre which is undoubtedly the earliest of his existing works. Another work dating from his first period at Florence, the panel of St. Jerome in the Gallery of the Vatican, is connected in a similar manner with a head of an old man with deeply sunk eyes and parted lips in the group on the right of the Madonna. These two figures, in which the marks of emaciation are followed out with an anatomical precision, may perhaps serve as an indication that even during the period of preparation of this first great commission the scientific spirit was at work in him and that its urgency may have been one of the reasons why he left it unfinished.

As regards what Calvi has termed the *vexata quaestio*, presented by the existence of the two versions of the Virgin of the Rocks composition in the Louvre and the National Gallery, and the irreconcilable claims made by critics on behalf of each, the smoke of controversy has now died away sufficiently to enable it to be seen that there is a distinct preponderance of opinion in favour of regarding the Louvre picture as the earlier of the two versions. Stylistic reasons

alone convince me of the accuracy of this view. It is distinctively Florentine in the impression which its prevailing characteristics make upon the beholder. In the glow of its colour, in all its firmness and suppleness of line, in its wealth of detail, the rich decoration of plants and flowers, free fold of robe, curve of rounded limb, it is – despite a certain added richness of tone – to the work of the Florentines of the Quattrocento, to Verrocchio, Lorenzo di Credi, Botticelli, that we look for analogies. If not painted while in association with them, it was painted before such association had long ceased. No less clearly are the analogies which present themselves to the mind in looking at the picture in the National Gallery with the works of those masters such as the Milanese Foppa and Borgognone, in whose vision by comparison with that of the Florentines it may be said that 'colour exists no more than line, there is only light and shade,' the excellence of the disposition of the light being its predominant characteristic.

The fact that what are undoubtedly authentic drawings have been used for the preparation of both pictures, the drawing of the head of an angel in the Royal Library at Turin being the study on which the Louvre picture is based, while that of the Infant Christ at Windsor has served no less certainly for the composition of that in the National Gallery, shows a direct connection of each with Leonardo. A close examination of the two, or even a comparison of photographs, is sufficient to dispel the illusion that either is in any real or exact sense a copy of the other, the numerous differences not being those which a copyist would conceivably make, but resulting from minute but deliberate changes in grouping and arrangement. To the visual evidence must be added that of certain documents discovered comparatively recently in the Milanese Archives.

The first shows that a contract was entered into on the twenty-fifth of April 1483, between Leonardo and the brothers Evangelista and Giovanni Ambrogio Preda on the

one part, and the brotherhood of the Conception of the Church of S. Francesco in Milan on the other part, for the gilding, colouring and painting of an altar-piece of which the carving had been commissioned three years previously. The altar-piece was to be of the Madonna and Child in oil. It was to be completed for the feast of the Conception (eighth of December) 1483, the price being fixed at 800 Imperial lire, or as much in excess of this sum as its value should prove to be when estimated by three assessors appointed by the brotherhood. A second document, undated, contains a petition to the Duke of Milan from Giovanni Ambrogio Preda and Leonardo da Vinci in which, after enumerating the clauses of the contract and the conditions which it contained as to a revaluation, they request that either the officials appointed should be required to discharge their duties under oath, or that others should be put in their place, they having valued the picture at twenty-five ducats, whereas a purchaser has been found willing to give a hundred ducats for it. Further documents show that this petition, or one identical with it, was presented to Louis XII, and was sent on the ninth of March 1503 by the French King to the Governor of Milan, accompanied by a letter in which he instructed him to inquire into the matter and cause justice to be done. Leonardo was then in Florence engaged on the Battle of Anghiari, but on the thirtieth of May 1506 he obtained leave of absence from the Signoria for three months in order to go to Milan. According to a memorandum of the facts as to the commission dated in the following June, Leonardo and the brothers Preda had delivered the picture for the altar to the brotherhood several years previously, 'jam pluribus annis preteritis,' and this event is stated to have taken place before the death of Evangelista Preda, which occurred very soon after the twenty-seventh of December 1490. It may therefore be assumed that the date at which the altar-piece was painted was between April 1483 and 1490.

A further document shows that three assessors were appointed in April 1506, and came to an agreement, having seen the altar-piece and heard evidence as to Leonardo and Giovanni Ambrogio having already received 830 Imperial lire, and as to the altar-piece not being finished that it should be finished within two years, and that Leonardo should come to Milan for the purpose, and that an additional 200 lire should be paid to the two artists in two instalments, which payments were made in August 1507 and October 1508. The documents referred to are all to be found in Beltrami's *Documenti e Memorie*. The best abstract of them is to be found in the commentary in Signor Poggi's edition of Vasari's *Life of Leonardo*. It was just at this time, as Signor Poggi points out, on the thirtieth of May 1506, that Leonardo, who had been at work on the Anghiari commission, obtained leave of absence for three months from the Signoria of Florence in order to go to Milan at the request of the French governor.

The history of the two pictures may be summarized briefly thus: That at Paris was certainly at Fontainebleau in 1625, when it was referred to by Cassiano del Pozzo, and again by le Père Dan in 1642. Tradition says that it passed into the French Royal Collection in the reign of Francis I. The picture in the National Gallery, bought in 1880 from the collection of the Earl of Suffolk, had belonged previously to the Marquis of Lansdowne, and before then to the painter Gavin Hamilton, who bought it in 1785 out of the hospital in Milan, which had acquired the site formerly occupied by the brotherhood of S. Francesco. There can be no doubt of its identity with the altar-piece seen there and described by Lomazzo in 1584.

The most natural way of reconciling the stylistic evidence of the two pictures with the documentary evidence of Leonardo's activity is to suppose that the Paris picture was painted soon after the year 1483, and that after having, as is clearly stated, passed into the possession of the monks of

S. Francesco it was sold with their consent, possibly as a sequel to that petition of the two artists to the Duke of Milan, in which the fact of someone having been found ready to give a hundred ducats for the picture is cited as evidence of its having been undervalued by the assessors. In this case it would be quite natural to suppose that as a condition of the consent of the monks to surrender the picture Leonardo and Giovanni Ambrogio Preda undertook to replace it, and that this promise was not fully redeemed until the years 1507 and 1508, when the picture now in the National Gallery was completed. Already before this period, as we know from the testimony of Fra Pietro da Nuvolaria writing to Isabella d'Este from Florence in April 1501, Leonardo was in the habit on occasions of committing to assistants the execution of a large part of some of his commissions: 'he has not executed any other work, except that his two assistants paint portraits, and he, at times, lends a hand to one or another of them.' Whereas consequently the earlier document speaks of the altar-piece completed before 1490 specifically as the work of Leonardo 'la dicta nostra donna facta a olio per lo dicto florentino,' the replica for which, as the later documents show, payments were made in 1507 and 1508 to both Leonardo and Giovanni Ambrogio Preda, was in fact the work of both painters, the design being entirely Leonardo's, the subsidiary detail and a part of the execution being the work of Preda, whose art changed very little during his association with Leonardo and to whose training in Milanese technique may be attributed the somewhat leaden flesh colouring. This seems the most natural way of reconciling these various documents, one of which refers to an altar-piece by Leonardo as having been executed for the monks of S. Francesco between 1483 and 1490, while another mentions the fact of payments having been made in 1507 and 1508 to him and Giovanni Ambrogio Preda for the completion of such an altar-piece. There is, it may be admitted, some slight improbability attaching to the supposi-

tion that Leonardo, whose mind, as his earliest biographer wrote, 'was always devising new things,' was in any considerable measure responsible for executing with the help of an assistant what though freely conceived must be regarded as a replica of one of his own works. But against any preconceived convictions of what he would or would not have been likely to do must be set the positive evidence of the documents and also the fact that the records of his employment in Milan under the French governor show him constrained by circumstances and obliged to work at the suggestion of his patrons. Even so pressure of circumstances led him, as his letters to Ludovic show, in the latter days of the Sforza regime to suspend some commissions and occupy himself with others in order to gain a living. As the result shows, the picture in the National Gallery, although only partially in execution the work of Leonardo, is rich in illustration of what was in fact the ultimate tendency of his art. For as he wrote in the treatise on painting, 'it requires much more observation and study to arrive at perfection in the shadowing of a picture than in merely drawing the lines of it.' The full revelation of the ripe maturity of this power is now visible only in two works, and of these the one is little more than a ruin.

You stand in the refectory of S. Maria delle Grazie at Milan, where the fresco of the Last Supper moulders and fades on the wall. It is the relic of what was conceived in perfect symmetry of arrangement, with profound dramatic intensity of feeling and power to interpret emotion vivid in restraint, and relic though it be the initial purpose still abides amid its desolation and decay. 'Do the thing with a great amount of labour,' says Michelangelo, 'so that it seems to have been done almost without any.' So consummate the art that it seems wellnigh effortless, and you forget at once the scientific exactness of the disposition of the light, you forget the technical subtilty of the space composition, you forget, if you ever became conscious of it, the fact that the grouping of the heads of the disciples is based on the sym-

metry of precise mathematical figures. All the toil of preparation wellnigh infinite; all the hesitations and changes of purpose of which the many studies of separate figures in the royal collection at Windsor and elsewhere serve as a testimony, are alike forgotten in the all-pervading consciousness of the nature of the action which is passing before your eyes. This absorption is the instinctive tribute to the naturalness of the artist's work. 'You must depict your figures,' he explains, 'with gestures which will show what the figure has in his mind, otherwise your art will not be praiseworthy.' The claim of painting by contrast with all the other arts is set forth simply and succinctly in the words 'the painter strives and competes with nature' (Il dipintore disputa e gareggia con la natura).

In a section of his treatise on painting, in which he claims for it a wider intellectual range than sculpture, he speaks of the painter as constrained by necessity to amalgamate his mind with the very mind of nature and to become the interpreter between nature and art, and offers as instances of the power of painting to embrace and comprehend within itself all visible things the painter's ability to show the colours of all objects and their gradations, and to show various distances with the gradations of colour producing interposition of the air between the objects and the eye. And even as Dürer, who claimed for himself that what he set down with the pen he did with the hand, so also Leonardo in the Mona Lisa, which, though somewhat darkened by time, presents his art at its apogee. Subtlest sense of space gradation so that you see the very air that ripples in the curve of the cheek and plays on the loosened hair; and in the light of sundown which transmutes all that it touches to softness and beauty you see how the haze of distance invades the rhythmic curve of the winding river and the far spaces of the fretted hills, so imperceptibly almost as to serve to recall his dictum of how the air which is interposed between the eye and the remote object conceals that object as the veils

in draped figures which reveal the naked flesh beneath them. The fullness of structural power which the figure reveals is subdued in perfect harmony and symmetry with nature. As Arnold wrote of Shakespeare:

'Others abide our question. Thou art free.'

Shrouded in faultless technique it lives in apparently effortless perfection as an eternal enigma of beauty mocking at time. If it were not for a passage in Vasari we should know practically nothing of its genesis, and as it is we know but little. The very unusual fact of there being no drawing in existence which can with any certainty be regarded as a preparatory study might be less strange if the work were an improvisation flung off in the heat of inspiration, whereas, according to Vasari, Leonardo worked upon it for four years, and finally left it unfinished. May we interpret the last statement to mean that when circumstances brought about that his work on the picture ceased Leonardo was still unsatisfied in his desire of expression? 'When,' he says, 'the artist's work falls short of his ideal it never ceases to improve unless avarice checks it.' Something of the same power of structure and expressiveness, indicated in subtlest variations of contour and movement, is seen in various studies for paintings, such as that at Windsor of Neptune with his horses lashing the water into spray with their hoofs, that in the Louvre for a portrait of Isabella d'Este, which from the gaiety and animation of the face as indicated in the contour and modelling would, if completed, have proved an intellectual counterpart to the Mona Lisa, and the cartoon in black chalk in the Diploma Gallery of Burlington House of the figures of the Virgin and Child with S. Anne and S. John, which from its composition is probably identical with the cartoon described by Vasari as having been executed by Leonardo comparatively soon after his return to Florence from Milan. It was the first commission given him after his return, but it was only after considerable delay that the

cartoon was prepared and exhibited. During this period it may be conjectured that his plastic sense was stirred to its depths by renewed contact with the influences of Florence, and in this monochrome as a consequence that element of sculpture, which as has been said exists in all good painting, is the dominating factor, curve and shadow of cheek, dimpled hollow of rounded limb being rendered with such a delicate and penetrating sense of values as to produce an effect absolutely prehensile. For what reason does not appear this cartoon was never apparently used by Leonardo as the base of a picture. In place of this conception in which the Virgin is the chief figure and S. Anne, whose head is visible behind her shoulder, is subsidiary, we find that in the picture which he painted at a later period of the Virgin and Child with S. Anne, now in the Louvre, the parts are reversed. The question of priority as between the two conceptions can only be decided on stylistic grounds, Vasari's account of the cartoon exhibited in Florence blending features which belong to both, the Child being in the lap of the Virgin in the one, the lamb only occurring in the other. In what we conceive to be the ultimate form in the Louvre the head of S. Anne, august as a sibyl, towers as the apex of a triangle, the Virgin sitting on her knee is bending down holding the Child, who is on the ground playing with a lamb. Various parts entrance by their perfection of technique, the heads of S. Anne and of the Virgin, the sleeve of the latter's outstretched right arm, the fantastically conceived delectable mountains in the background. In the conception as a whole, however, there is a certain virtuosity. In the arrangement of the figures within the limits of the triangle, the Virgin being as a consequence bent almost double, there is an excess of ingenuity which seems to have sprung from *bravura* rather than from natural artistic impulse. It heralds the time when, in the conflict that waged in Leonardo's complex personality, the scientist had definitely mastered the artist.

The composition seems really merely a problem in arrange-

ment, and we think of it as a sequence of difficulties triumphantly solved.

Of still later date apparently is the half-length figure of S. John in the Louvre, which was one of the pictures referred to in the diary of the visit paid to Leonardo's house at Amboise by the Cardinal of Aragon two years before his death. In this the problem is exclusively one of chiaroscuro, the androgynous head, shoulder and arm being seen in relief against a dark background. The modelling of the upraised arm presents a union of softness and virility far in excess of any of the work of Leonardo's pupils, and for this part of the design we have his own sign manual in a drawing in black chalk in the Codice Atlantico which represents the right hand with thumb and index finger pointing upwards. This picture, however, like the version in the National Gallery of the Virgin of the Rocks, and also probably the Virgin with S. Anne in the Louvre, dates from a period at which the greater part of the work of executing his pictures was, as we know from contemporary testimony, entrusted to his assistants, and it is therefore more natural to anticipate unevenness of quality.

§ 2

Does the list thus far enumerated – the Annunciation in the Louvre, the S. Jerome, the Adoration of the Magi, the Virgin of the Rocks in the Louvre, the Last Supper, the Mona Lisa, the Virgin of the Rocks in the National Gallery, the S. Anne and the S. John – with whatever reservations may be found necessary as to the precise extent of his work in the execution of the last three – contain all the existings work in painting which may with a reasonable measure of confidence be attributed to Leonardo? Twenty-four years ago I thought it did, and said as much when I wrote a short monograph on his work as an artist. Since then I have changed my opinion and I now think that certain other works should also be attributed to him. An index to the said

monograph reminds me usefully, from the number of references which it contains to the works of Morelli and Berenson, how great is the debt I owe to both in all that relates to the systematic study of Italian art. The former especially first taught me to use my own eyes. What he terms the experimental method, the identification by the study of the individual parts which go to make up form, is a piece of reasoning which might have emanated from Leonardo. As Sir Claude Phillips said, 'it would be as absurd to return to a pre-Morellian period of criticism as it would be to study natural science without profiting by the discoveries of Darwin.'

But Morelli never claimed for his method that it was more than an aid to connoisseurship which might in course of time come to serve as a more solid basis for that science of art criticism which he hoped to see established. Even connoisseurship itself does not now seem quite so exact a science as it did when I first fell under the spell of Morelli's eloquence. The very varying conclusions of its foremost exponents would forbid the thought. I followed Morelli in considering the profile portrait in the Ambrosiana to be the work of Ambrogio de Predis, but I do not now think that the characteristics of this painter, so far as they can be ascertained from his documented works, altogether warrant the ascription to him of this picture which has an inexhaustible charm for the beholder typical of that epoch of the Italian Renaissance which witnessed its birth.

Since Morelli first studied the work of this Lombard painter whose name he rescued from oblivion, the discovery of the various documents which relate to the commission for the altar-piece of S. Francesco at Milan has defined the nature of the artistic relationship which existed between Leonardo and Ambrogio de Predis, and has also furnished evidence of Ambrogio de Predis' authorship of the wings, and of his part authorship in the altar-piece itself. The more the execution of the latter is denied to Leonardo the more it follows from these documents that it must be considered

the work of de Predis. Morelli, writing before the discovery of these documents, had necessarily only a partial insight into the latter's manner, and he shows this by the fact that he denied that either Leonardo or de Predis had any share in the execution either of the version of the altar-piece now in the National Gallery or of the two wings which now accompany it. The art of Ambrogio de Predis in his earlier period, the best authentic example being perhaps the signed portrait of the Emperor Maximilian at Vienna, is essentially that of the miniaturist. The same characteristics are found with some meticulous repetition in the portrait of Bianca Maria Sforza, now in the Widener Collection at Philadelphia. In a later period he attempted, not altogether unsuccessfully, to swim in Leonardo's orbit, but his works always have a somewhat leaden impasto which derives from the earlier school of Milan in which his art was first formed.

The portrait in the Ambrosiana has a distinction and grace which certainly are not to be found in any other work attributed to de Predis by any critic. The tradition of its ascription to Leonardo goes back at least as far as the year 1618, when it was described in a deed of gift from Cardinal Federico Borromeo to the Ambrosiana Library as 'un ritrato d'una duchessa di Milano, dal mezzo in su, di mano di Leonardo.' A tradition which has its roots in a city so intimately associated with Leonardo as was Milan, and this within a century of his death, would of itself merit some special consideration, and this is enhanced by the fact of its having received the imprimatur of that Cardinal Borromeo to whose great share in the enrichment of the intellectual life of Milan during the first quarter of the seventeenth century tribute has been paid by Alessandro Manzoni. Founder of the Accademia delle Belle Arti of Milan, and also of the famous Ambrosiana Library, in the formation of which he employed eight agents to collect manuscripts in Europe and the East, and which during his lifetime became the repository of no less than thirteen of the volumes of Leonardo's manuscripts,

Cardinal Borromeo had exceptionally favourable opportunities of acquiring a critical knowledge of Leonardo's work. The fact that he did so is shown by a passage in his *Museum*, in which he refers to Luini as having repeated in colour in his Madonna and Child with S. Anne the cartoon of Leonardo. In another passage of this work, referring to the profile portrait, he has changed the description, which in the deed of gift was 'a duchess of Milan,' to 'one of our princesses,' 'unam principum nostrorum.' So during the seven years which intervened between the deed of gift and the composition of the *Museum* he has to some extent apparently modified his opinion as to the identity of the subject, but in each instance he attributes the picture to Leonardo.

The tradition subsisted for upwards of two and a half centuries, that is until Morelli.

If the figure be compared with such characteristic Leonardo drawings as the silverpoint of the head of a young woman in right profile at Windsor and the silverpoint of the head in left profile bending forward on greenish paper in the Vallardi Collection in the Louvre, the structure of the head and the treatment of functional lines, especially in the nose and mouth and chin, do not seem in any way inconsistent with the theory of Leonardo's authorship.

The treatment of the hair is not quite as Leonardo advised in his treatise on painting, he there being in favour of representing it in greater freedom, but with all its charm the mouth has a firmness which suggests that the lady's own ideas about a coiffure had to be consulted. Portraiture is the form of painting in which questions of attribution are most difficult. Two personalities go to make up the result, and a portrait has necessarily a divergence from the ideal type. Where, as in this panel, neither hands nor ears are visible the most readily defined sign manuals of the artist according to Morelli's method are lacking and the difficulty of judgment is correspondingly increased. There is a certain almost archaistic simplicity of arrangement which has per-

haps more in common with that of some of the types in Ghirlandaio's frescoes in S. Maria Novella than in any works produced out of Florence. It is easier to conceive Leonardo as stirred somewhat out of his ordinary course by the suggestions which the beauty of the sitter produced than to believe that Ambrogio de Predis' methods could have been so transformed.

Tradition has identified the Duchess of Milan of Cardinal Borromeo's first reference with Beatrice d'Este, but the comparison with authentic representations, such as the bust in the Louvre of Beatrice in girlhood by Gian Cristoforo Romano, if not entirely destructive of the theory is far from confirming it, unless we can assume that the artist allowed himself very considerable latitude. In his later reference Cardinal Borromeo styled it 'a Milanese princess,' and we are on safer ground in following him. Bianca Maria Sforza, who married the Emperor Maximilian, Isabella of Aragon wife of Gian Galeazzo, Cecilia Gallerani, Domitilla Trivulzio, all have their supporters; but perhaps the name least exposed to the enfilading fire of criticism is that of Bianca Sforza, a natural daughter of Ludovic who in 1489, while still a child, was married to the famous Captain Galeazzo di Sanseverino, and died in November 1496. No authentic portrait avails for purposes of comparison. It was this Galeazzo whose 'big jennet' and 'Sicilian horse' Leonardo studied as models for the Sforza statue, and in whose house he stayed, as he records in a note in the Codice Atlantico, in order to devise costumes for a tournament: this exquisite record of Milanese beauty may conceivably owe its origin to some such occasion. The interlacing pattern of the embroidery on the robe presents a close analogy with many studies of *intrecciamenti* which occur in the manuscripts. It is curious that in a despatch sent to Mantua in 1493, by the Duchess of Ferrara's maid-of-honour, we find the Duchess Beatrice referred to as wearing a robe embroidered with a pattern of knots, compasses and many ribbons 'after her favourite fashion.'

Such fashions, however, are too general to serve as base for any theory.

Among various works mentioned by Leonardo's early biographers is a portrait of Ginevra dei Benci, daughter of Amerigo Benci, in whose house, according to Vasari, his Adoration of the Magi remained when left unfinished. The Anonimo Gaddiano says the portrait was painted in Florence from the life and finished so well that it did not seem to be her portrait but Ginevra herself. Vasari describes it laconically as a very beautiful thing. We know from a manuscript in the National Library of Florence that Ginevra dei Benci was married in the year 1473, at the age of sixteen, to a certain Luigi di Bernardo Niccolini. It was at one time believed that she died in the same year, but recent research in the Florentine archives has shown that this belief originated in a confusion with Niccolini's first wife, and that Ginevra was still living in August 1490. The portrait, therefore, might have been painted at any time before Leonardo went to Milan, but from the fact of Leonardo's intimacy with her father it is natural to suppose it to have been painted either about or soon after the date of her marriage, that is during the period of Leonardo's closest association with Verrocchio.

It was Bode who first suggested that this picture is identical with the panel portrait of a lady, head and half-bust, in the Liechtenstein Gallery at Vienna, which Waagen had on stylistic grounds attributed to Leonardo. The ascription was contested by Morelli and Berenson, who both attribute the picture to Verrocchio. When I first saw the picture in the Liechtenstein Gallery I was content to accept this attribution, but on revisiting Vienna some years afterwards I formed the opinion that the picture was more probably the work of Leonardo himself, painted during the period of his closest association with Verrocchio when therefore the sculptural element was most prominent in his compositions, it being especially visible here in the firm plastic modelling of features and bust, but showing its lineage in the enhanced angularity,

lissomness, mobility, as compared with Verrocchio's bust in the Bargello of the Lady with a Bouquet. The same difference of type is seen in inception in the angel which tradition says Leonardo painted in Verrocchio's Baptism. The extreme beauty of the vista of landscape seen in the background on the right reinforced this opinion, for both Leonardo's earliest dated drawing and the Louvre Annunciation, which is his earliest painting, reveal how innate was his interest in and feeling for landscape. I had not, however, then realized what Bode had already pointed out, that the tree which forms as it were a huge cushion behind the lady's head is a juniper, and that in an *impresa* or heraldic device on the reverse of the panel, within a crown made up of a branch of laurel and palm, stands a sprig of juniper encircled by a scroll on which appear the words 'Virtutem Forma Decorat.' The fact of the juniper (ginepro) being introduced in the picture and also in the *impresa* points to it being a reference to the person portrayed, whose name, therefore, is presumably Ginevra.

The fact of Leonardo having painted a portrait of Ginevra dei Benci is recorded by the early biographers. Since on stylistic grounds the Liechtenstein portrait would seem to be the work of Leonardo, painted at about the period when his association with Verrocchio was closest, that is between the years 1473 and 1476, since during these years Ginevra dei Benci was in the flower of her youth, and the age of the sitter of the picture in the Liechtenstein is approximately what hers would be at that time, since moreover the double introduction of the juniper points to Ginevra being the name of the lady whose portrait was painted, the identity of the picture in the Liechtenstein Gallery with the portrait of Ginevra dei Benci painted by Leonardo may, I think, be considered as established.

The fact that Leonardo very soon after his arrival in Milan painted a portrait of Cecilia Gallerani is established beyond any doubt by contemporary references to it. The fourteenth

sonnet in Bernardo Bellincioni's *Rime*, entitled 'Sopra il ritratto di Madonna Cecilia qual fece maestro Leonardo,' is composed in the form of a dialogue between the Poet and Nature, the latter confessing to envy of Leonardo for having made Cecilia so beautiful that the radiance of her eyes makes the sun seem a dim shadow, the former arguing that Nature herself shares in the honour of what the painter has done. Bellincioni died in September 1492, and the picture must therefore have been painted before that date. We gain a feeling of greater intimacy with it than is to be obtained from Bellincioni's rather empty phrases from a correspondence about it which took place in the year 1498 between Isabella d'Este and Cecilia herself, who had then become the wife of Count Bergamini. Isabella d'Este's letter, which bears the date twenty-sixth April 1498, states that having seen on that day some fine portraits by Giovanni Bellini she has been discussing the works of Leonardo, and wishes to see some in order to compare them with those that she possesses, and remembering, therefore, that Leonardo painted Cecilia Gallerani's portrait she begs her to send it to her by her messenger, expressing her desire to see the picture for the sake of its subject as well as on account of the artist. Three days later Cecilia Gallerani, sending her portrait, said in an accompanying note that she would do so with even greater pleasure if it were more like her, but that her Highness must not imagine that in saying this she is imputing any blame to the master, since in truth she does not believe that his equal is to be found, but the portrait was made when she was quite a girl (in una età si imperfecta), and her features have changed so much that seeing it and seeing her no one would suppose it to be meant for her.

As in the year 1481 Ludovic Sforza presented Cecilia Gallerani with an estate at Saronno, it follows presumably that the connection between them commenced at about this time, and as in her letter to Isabella d'Este she speaks of her portrait as having been painted when she was quite a

girl it would seem that it was one of the first commissions undertaken by Leonardo after his arrival at Milan. From the correspondence between Cecilia Gallerani and Isabella d'Este it follows that in the year 1498 the portrait was at Milan. There the record ceases.

The half-length portrait of a lady holding in her arms an ermine or stoat in the Museum at Cracow was acquired by Prince Adam Czartoryski towards the end of the eighteenth century. Its traditional ascription to Leonardo may be inferred from the fact that at some unknown period the words 'La Belle Feroniere' were inscribed on the frame. Müller-Walde was the first modern critic to admit its authenticity in his book on Leonardo published in the year 1889. Nine years later in the sixth of his Beiträge in the Prussian Jahrbuch he reproduced part of a page of the Windsor Manuscripts where, just above a drawing of a submarine boat, there is a slight sketch of a female figure. Just as a tiny sketch which the zeal of the same critic discovered on a page of the Codice Atlantico is undoubtedly the first conception of Leonardo's Leda composition, so this may conceivably be the first conception of the picture at Cracow. Should, however, this be deemed the case, it would not necessarily follow that the picture itself was the work of Leonardo. The sketch has no connection with the submarine, and from the lesser degree of density of the ink would seem to have been made at an earlier date. Comparison with the Cracow picture reproduced below on Müller-Walde's page shows that although the head in the sketch is slightly more tilted, the carriage and expression have a marked resemblance. The unusual position of the right forearm as indicated in the sketch would agree with the hand holding the ermine in the picture, but the sketch is of so slight a nature that any inference based upon it can only be tentative.

The outstanding sculptural qualities of the Cracow picture were described with cogency by Carotti in his book on Leonardo, Raphael and Bramante: 'in the colouring of the

face, the breast, and above all of the right hand,' he says, 'there are still the unsurpassed excellences of the modelling of Leonardo; the head of the weasel (faina) is all that one can imagine of what is most true and most strange, most perfect and most original.' Some parts of the picture, according to the same critic, have suffered much from repainting, but the quality of the portions indicated even as revealed in reproductions would seem to justify entirely the verdict of Carotti. The lineaments are undoubtedly a portrait. They have an individuality which separates them from the ideal type of the subject piece. The drawing of the hand is masterly with an anatomist's power and precision of structure. The modelling of the head and bust has the firm plastic touch of the Ambrosiana profile portrait with which it must be nearly contemporary, the contours in this instance being somewhat more sharply defined.

The apparently effortless veracity of the head and webbed feet of the ermine is as convincing as a study of Pisanello. What other Italian artist except Leonardo, if for any motive he had decided to introduce an ermine into his picture in this way, would have surrendered himself to the task with such a naturalist's zeal as seen in the treatment of the rim of the cartilage of the ears, the fur of the head and neck, the deep-set furtive eyes, sharp little pointed claws, lines and furrows of nose, all of which make it seem that for the time the scientist was as dominant in the mind of the artist as it was in Leonardo when he drew the sheets of zoological studies at Windsor of cats, lynxes, panthers, and all the kindred of the lion?

The portrait represents a beautiful woman of a distinctly intellectual type. The simplicity of the attire does not suggest either great wealth or rank, but everything points to refinement. What differentiates the picture sharply from all other portraits is the strange creature which the sitter clasps in her arms. Can we wrest from it its veiled significance as from the juniper in the Liechtenstein portrait?

The ermine is referred to in *Fiore di Virtù* as an emblem of purity. Leonardo, as his manuscripts show, used this work so freely that the creature would naturally have for him this significance. But had it a special, a veiled significance beside? Was any other reason present in his mind? An editorial note in a number of the *Burlington Magazine* is cited by Poggi as supplying what is a possible and perhaps a correct solution of the question.

The Greek word for ermine is *γαλεη* or *γαλη*, and therefore the creature might be represented in order to indicate the identity of a sitter, of whose name 'Gallerani' it formed the first two syllables. This would be exactly what might be expected from Leonardo. His fondness for *imprese*, rebuses, and all the language of symbolism, found a natural outlet in the choice of such a creature, and the rendering of it in its complete naturalism appears a very sign manual of his art.

As Schiaparelli has shown, the right hand of the portrait is further linked with Leonardo by its reappearance in what is practically an identical position in a Sacra Conversazione in the Galleria del Seminario at Venice which he assigns to Ambrogio de Predis, and which seems to be a strangely incongruous pastiche of Leonardesque motives and types. The attitude of the hand in this picture is, as Schiaparelli points out, quite unsuitable for the occupation upon which it is engaged, namely that of supporting the right hand of Christ which is raised in benediction.

§ 3

Leonardo's activity as a painter was small as compared with that of most of his contemporaries. Many of these practised more than one art, but none approached him in versatility. As a consequence of his study in other fields he brought to this a wider knowledge. As Mr. Berenson has said, 'because he had much more to do than paint he has left all of us heirs to one or two of the supremest works of

art ever created.' The Morelli school of criticism made ruthless inroads against the accretions which tradition had gathered round his name. In a few instances the pruning may have been too severe, but the result, inasmuch as it reveals the essential homogeneity of the few admittedly authentic works, testifies more truly to his position in art than the prodigality of some later critics. He had also something of the malady of the ideal. Not only was the desire of perfection ever in his mind, but it operated to make him abandon works so soon as it appeared that the far-off standard would not be attained.

Lomazzo, who gathered up Milanese traditions about him, says in the *Tempio* that he seemed always to be trembling when he started to paint and could finish nothing that he began, for he was so conscious of the greatness of art that he saw faults in works which to others seemed marvellous creations. Leonardo himself says that when an artist's aim goes beyond his work 'he will compose but few works, but they will be such that men will gaze in wonder upon their perfection.'

It would be doing ill service to his fame to seek to cumber it with any work unless it served in some scant measure to indicate some stage in the approach to the ideal. We must, however, as Sir Herbert Cook has said, 'rule out the Mona Lisa standard' because we must recognize a period of comparative immaturity during which the well-springs of his art were Florentine of the Quattrocento.

Connoisseurship, however, is even more difficult in respect of the later period when the practice of art became more intermittent and more of the execution devolved upon others. In a letter written from Florence in April 1501, by the Vicar-General of the Carmelites, Fra Pietro da Nuvolaria, in reply to the inquiries of Isabella d'Este as to Leonardo's activities and plans, after a graphic description of the sketch for the cartoon for the Madonna with S. Anne he adds, 'he has not executed any other work except that his two

assistants paint portraits, and he, at times, lends a hand to one or another of them. He gives profound study to geometry, and grows most impatient of painting.' The portrait in the Louvre generally known as 'La Belle Ferronnière' may possibly be a work of this character, the assistant in this particular case being Boltraffio, to whose altar-piece in the same gallery known as the Madonna of the Casio family it shows a far closer resemblance in design, modelling and colour than it does to any of the authentic works of Leonardo.

The identity of the subject is no more a matter of agreement than is the question of attribution. Le Père Dan in 1642 called the picture a portrait of a Duchess of Mantua. A hundred years later the official catalogue styled it Anne Boleyn. Owing perhaps to the fact that the lady is wearing a *ferronnière*, a chain with jewel clasp, round her forehead, the title La Belle Ferronnière was transferred to it in confusion with another picture, No. 1605, which was for a time lost. The title has reference to the wife of Jean Feron, a favourite of Francis the First, who died before Leonardo went to France. The present official title of the picture, 'portrait presumé de Lucrezia Crivelli,' has no direct evidence whatever in support of it. It arises from the fact that Leonardo is known to have painted a portrait of this lady, the picture being referred to in three Latin epigrams that occur in the Codice Atlantico and which were probably sent to him by an admirer. Lucrezia Crivelli was one of Duchess Beatrice's ladies-in-waiting who, in the year 1496, as the Milanese chroniclers relate, became openly the mistress of Ludovic Sforza. It was at about this time presumably that the portrait was commissioned, and if, as may be supposed, the Duke's desires would be satisfied with a work painted by Boltraffio in which the share of Leonardo was confined to having perhaps 'lent a hand at times' there does not seem to be much objection other than the lack of any direct evidence to the present title of the picture. The perfection of the

technique tends to obscure the fact that the composition is not entirely characteristic of Leonardo. It lacks something of his accustomed freedom. This has been well expressed by Malaguzzi-Valeri: 'not thus,' he says, 'would Leonardo have devised; not thus archaically would he have conceived her, letting the arms fall so as not to show the hands out of which the supreme artist knew how to create marvels of expression held in restraint; not thus firmly and closely adhering to the temples even to the point of breaking away from the fashion would Leonardo have made the hair, which in the picture, even in the manner in which it is painted, has something of the effect of a wig, closely resembling that in the portrait by Boltraffio in the possession of Count Borromeo.' In sharp contrast to this description, which represents very fairly the impression produced by the treatment of the hair in the picture, we may quote Leonardo's own precept from the *Treatise on Painting* (Ludwig 404): 'In thy heads let the hair sport with the wind thou depictest around youthful countenances, and adorn them gracefully with various turns, and do not as those who plaster their faces with gum and make the faces seem as if they were of glass. This is a human folly which is always on the increase, and the mariners do not satisfy it who bring Arabic gums from the East, so as to prevent the smoothness of the hair from being ruffled by the wind' (Baring *trans.*).

The two pictures ascribed to Leonardo in the Hermitage Gallery, known as the Litta and Benois Madonnas, are only known to me from photographs, and the impression rendered by these is too partial to serve as at all a sure basis for forming an opinion on the question of authenticity. Light is the queen of colours, as S. Augustine wrote, but she must have her court around her for her full radiance to be seen. But opinions will get formed although the data be insufficient. From the fact that the fine silver-point drawing in the Vallardi Collection in the Louvre, which has served as a study for the head of the Virgin in the Litta Madonna, far

transcends it in virility and plastic quality of modelling it is natural to infer that the picture is the work of an assistant, who made use of Leonardo's drawing and whose work he may have supervised in the manner indicated in the letter of Fra Pietro da Nuvolaria. Drawings by Leonardo on folios 253 and 256 of the British Museum Manuscript (Arundel 263) have also been used for the head, foot, and hand of the Child. Morelli has set forth with what is apparently convincing detail the stylistic resemblances which connect the picture with the work of Bernardino de' Conti.

The Benois Madonna, lent from a private collection to an exhibition held in St. Petersburg in the year 1909, was there identified as a Leonardo by the Director of the Hermitage, and five years later was acquired for that Gallery. The attribution has been accepted by a redoubtable list of authorities, including Frizzoni, Bode, Berenson, Sirèn, Sir Herbert Cook and Sir Sidney Colvin, Adolfo and Leonello Venturi. Such a consensus of opinion might well suffice to silence controversy, and yet a few phrases in the findings tend to make one wonder whether the judges have not come by their verdict rather lightly. It is doubtful surely whether they would make any similar criticisms about any other picture which they ascribe to Leonardo. Frizzoni calls it 'an effort not entirely successful if one admits certain obvious inequalities and imperfections.'

Sirèn says: 'the Child is strikingly big in relation to the mother – a weakness which comes out in the picture more than in the preparatory drawing. For the rest he is a *bambino* such as we often come upon in Lorenzo di Credi's paintings.'

Sir Sidney Colvin refers to 'the affinity of the heavy, somewhat clumsy type of Christ-Child with those painted about the same time by Lorenzo di Credi and others in the school of Verrocchio.'

Leonello Venturi says: 'the childish face of the Madonna is the only really beautiful and exquisitely spiritual part of the picture, the *bambino* being a mere insignificant doll.'

The last three statements in effect, though not in word, go far to remove the figure of the Child from the category of Leonardo's work. We feel the necessity of attempting to arrive at a fresh formula which shall more exactly define what appears to be the real attitude of the critics to the picture. Frizzoni's strictures about obvious inequalities and imperfections are couched in too general terms to help the inquiry, but they leave us in some doubt why the attribution was made if, as may be inferred from there being no mention of them, such inequalities and imperfections are not also discernible in the few documented works by Leonardo. The comments of the other three critics are all concerned with a particular portion of the picture, namely the figure of the Christ-Child: the lack of proportion of its size to that of the Madonna by contrast with the preparatory drawing is brought out by Sirèn; Sir Sidney Colvin mentions the heaviness and clumsiness of the figure; Leonello Venturi calls it an insignificant doll, 'insignificante pupattolo'; two of the three liken it to the type of Lorenzo di Credi.

Two critics stand apart from the others in the judgments. Gronau, in the *Zeitschrift für bildende Kunst* for July 1912, reproduced various compositions of a Madonna del Fiore of all of which the drawing by Leonardo in the British Museum is the source, attributing one at Dresden to Lorenzo di Credi, and postulating from their number the existence of a much-prized original he is in some doubt as to whether to identify this with the Benois Madonna, but finally observes that if the question should be decided in the negative its artistic importance will scarcely be lessened, since in any case it is the most faithful extant version of an authentic work of Leonardo, dating probably from the year 1478.

Jens Thiis, in his study of the Florentine Years of Leonardo, boldly attributes the picture to Lorenzo di Credi's pupil Sogliani, whom he characterizes as a late eclectic offshoot from the school of Verrocchio, adding the trenchant remark that the insignificant bland type of the Madonna

with the half-open mouth and the ear in the wrong place points to this artist. Without attempting to follow the consideration of this attribution, we may study the composition of the picture in the light of Thiis' statements, and we shall, I think, find that they are justified, that there is a look of weakness and insignificance about the type of the Madonna, and that the position of the ear is not quite as it should be.

Whatever the verdict of the various critics as to the authorship of the Benois Madonna, there is in the expression of it some reference which serves to show that the picture is connected in his mind either directly or indirectly with the art of Lorenzo di Credi, whose name recurs insistent throughout these extracts like the refrain of an old song.

The composition of the picture is undoubtedly founded upon a drawing by Leonardo in the British Museum representing the Madonna and Child with a flower. As, however, a considerable number of pictures which are certainly not the work of Leonardo were based upon his drawings no inference as to authenticity can be drawn from this fact. Not only were the drawings of the great artists among the common properties of their studios, but they were even offered for sale for the purpose of being used as studies. While the *motif* of the composition emanated from Leonardo, as Gronau has shown, Lorenzo di Credi was actively concerned in ringing the changes upon it, the Madonna at Dresden being a work of this character, and that in the Colonna Gallery at Rome, which reproduces very closely the composition of the Benois Madonna, being ascribed to Lorenzo by some critics. Morelli, who held it to be by a Flemish imitator of his, considered that it was probably by the same hand as the Dresden Madonna.

If one may venture an opinion from the study of photographs it would confirm this. The figure of the Child in the Benois Madonna does not seem primarily to associate itself with the work of Leonardo. Its expressionless solidity and

somewhat excessive fatness seem to seal it of the tribe of Lorenzo di Credi's creations. How closely the drawing resembles his may be seen by comparing the ear with Lorenzo's typical ear as reproduced in Morelli (*Italian Painters*, Vol. I, p. 90). The figure of the Madonna is more difficult to associate with the work of a particular master. There is far more attempt at expression. Enough to make us at any rate understand what Bode meant when he characterized the smile as a prelude to that of Mona Lisa.

But, on the other hand, the criticisms of design made by Thiis are valid. The smile is not quite successful. The mouth is vacuous and suggests adenoids. The ear seems out of place.

Théophile Gautier has said, 'Léonard de Vinci imprime à ses figures un tel cachet de supériorité, qu'on se sent troublé en leur présence.' If one felt in any way disturbed in the presence of the Benois Madonna it would surely be for a quite different reason. If accepted as the work of Leonardo it must presumably fall in date between the Louvre Annunciation and the Adoration of the Magi, and it therefore registers a temporary declension in power. It has lost the soft delicacy and grace of the one and the fumbling touch in the treatment of the Madonna and the ultra-solidity of the Child do not harmonize with the steady growth of power revealed in the sequence of studies for the Adoration.

In an article in the *Burlington Magazine* for February 1914, reviewing Thiis' book on Leonardo, Sir Charles Holmes has defined very luminously the probable share taken in the activities of Verrocchio's workshop by Leonardo and Lorenzo di Credi. The latter, as he says, 'must have been far more consistently serviceable to Verrocchio than the capricious Leonardo. He could take up the pictures such as the Uffizi Annunciation which Leonardo had left unfinished, and turn into pictures other designs by Verrocchio and Leonardo as Vasari tells us that he did.' This seems to suggest what is quite a possible, and on the whole, in view

of the conflicting nature of the evidence, perhaps the most probable, explanation of the origin of the Benois Madonna. If this were the case we may assume that Leonardo made a beginning on the cartoon on the lines of his drawing and commenced to execute the figure of the Madonna and then grew dissatisfied and abandoned the work, which was at some later date completed by Lorenzo di Credi, or possibly, as Thiis suggests, by his pupil Sogliani, but the evidence seems to connect the figure of the Child with Lorenzo di Credi himself. The difficulty of identification is shown by the testimony of Vasari that no one approached more nearly to the manner of Leonardo when imitating him than did Lorenzo di Credi, and on the testimony of the critics the picture lies between the two.

The ascription to Leonardo of the Annunciation in the Uffizi has no support from tradition. It had been attributed to Domenico Ghirlandaio previous to 1867, when it was removed from Monte Oliveto to the Uffizi and there styled a Leonardo. Morelli assigned it to Ridolfo Ghirlandaio. In a book written twenty-four years ago I said that I thought that the vexed question of its authorship had been solved by Mr. Berenson's attribution to Verrocchio, adding, however, the suggestion that possibly Lorenzo di Credi assisted him in the execution of the drapery and in the herbage of the foreground. I had not realized when I wrote this that the picture had a certain definite connection with Leonardo arising from the fact that, as I think Sir Sidney Colvin has shown, a drawing by Leonardo in the University Galleries at Oxford, representing the right arm of the angel raised in benediction, had been used as a preparatory study for the arm in this picture rather than, as I then thought, for that of the angel in the Louvre Annunciation. While this fact confirms Mr. Berenson's claim as against that of Morelli in so far as it places the work within the orbit of Verrocchio, it does not justify his ascription of it to that master, since there is a certain inherent improbability to be faced in the

supposition of Leonardo having made a preparatory study which was used by his own master in executing a commission. I thought then, and still think, that the heavy awkward folds of the dress of the Virgin, the meticulous treatment of the plants and herbage, and the elaborate carving of the coffer in the foreground, and still more the massive stone facings of the wall behind the Virgin, quite preclude the possibility of regarding the whole as a work by Lonardo. If these reasonings hold good, and somewhat divergent influences are found visible in the picture, it follows that we must look for a third artist within the circle of Verrocchio's studio as having been employed on the work, and here thoughts naturally turn to the industrious apprentice. It would perhaps meet the various difficulties in the simplest way if we accepted the suggestion offered by Sir Charles Holmes and endorsed by Frizzoni, that the angel should be regarded as the work of Leonardo, and the Madonna with no less certainty as the work of Lorenzo di Credi painted under the influence of Verrocchio, Lorenzo di Credi being also the artist responsible for the remainder of the composition.

The Ascension of Christ at Berlin and the Madonna and Child with a vase of flowers at Munich are instances of pictures attributed to Leonardo on the evidence of connoisseurship, and although it cannot be said that the claim has been established in either case, both have contributed to the sum of our knowledge of Leonardo's activity. A drawing by him in the Uffizi has undoubtedly been used for the head of S. Leonard in the Ascension, another in the British Museum has served as a study for the robe of the risen Christ. These facts serve to illustrate how in the studio of Verrocchio, in which the picture must have been produced, drawings by Leonardo served as the stock-in-trade of other assistants.

The exact parentage of works produced under such conditions will probably always remain to some extent a matter of conjecture. It would seem that Verrocchio's own share in the execution of most of the paintings done in his studio

was so small as to lend some colour to Vasari's account of his having given up the use of the brush altogether in chagrin at Leonardo's power of achievement. It would seem also that Leonardo's standard was so high as to prevent his continuing to execute a commission if once he grew dissatisfied with the portion of it already done.

That Verrocchio's share in supervision was a fairly active one may be inferred from the presence of a certain statuesque quality in all works produced in his studio. Their number justifies the assumption that there were other assistants at work there as well as those of whom we have record. Jens Thiis has attempted the assembling of the special characteristics of one of these whom he styles Alunno di Andrea, but it is open to doubt whether the weapons of the connoisseur can perform these creative feats with any hope of permanence apart from the help of documents. Lorenzo di Credi, however, figures in Vasari's page as the industrious apprentice, the successful imitator. Without enough imagination to pull him up when deviating from the path of the ideal he was always content to go on. The very pliancy of his temperament robs his works of homogeneity and adds to the difficulty of attribution, but it seems most natural to regard him as the most active member of the studio in the execution of commissions for pictures and therefore as bringing to completion some of those commenced by a more volatile temperament such as Leonardo.

The ascription of the Madonna at Munich to Leonardo by Bayersdorfer and Bode was the occasion of some of Morelli's choicest irony. The smoke of the controversy having now altogether blown away, it becomes apparent that Morelli's own position was no less open to criticism. The picture in question, a Madonna and Child with a vase of flowers, is so closely connected in treatment both with the Madonna and Child with S. John at Dresden, the silver-point study of the Madonna also there and the Benois Madonna, the resemblance being readily apparent in the brooch and the puckers

of the folds of the robe of the Madonna, and also in the type of the Child, that Morelli does not seem to be justified in so denying its Italian origin as to attribute it to a Flemish imitator of Verrocchio.

Sirèn seems to have considered all its characteristics more comprehensively. He would bring it definitely within the orbit of Leonardo by supposing it a free paraphrase of one of his lost works, perhaps of that Madonna with the Vase mentioned by Vasari as in the possession of Clement VII, in which he says among many other things he represented a vase full of water with many flowers in it, painted with marvellous truth, imitating drops of dew on the leaves so that they seemed more real than nature's self. The suggestion as to the origin of the composition gains weight not only from the vase of flowers but from such accessories as the two double arched windows and the rocky landscape which present undeniably Leonardesque characteristics, but the rather Teutonic type of the Virgin, which, as Sirèn says, approximates to that in the Uffizi Annunciation, constitutes a difficulty for those who cannot discern in either the lineaments of Leonardo's ideal type.

In a city so closely associated with Leonardo as was Milan tradition about his work might reasonably be supposed to have some basis of reality, but the tradition which connects his name with the male portrait in the Ambrosiana now known as the Musician has been fitful and capricious. In the early inventories it figures as a Luini, a Leonardo, and also as school of Luini. Tradition formerly called it a portrait of Il Moro, but this description would not stand the test of comparison with the authentic portraits which are fairly plentiful. It has, however, recently been discovered that it represents a musician, a hand holding a paper with notes of music and the letters *Cant* . . . *An* . . . having become visible as a result of cleaning. This discovery, however, does not throw any light on the question of who painted it.

The tradition of Leonardo's authorship was generally

accepted when Crowe and Cavalcaselle wrote, but Morelli half a century ago proclaimed in a sentence, which exemplifies how temerarious are the judgments of the connoisseur, that the picture had no connection either with de Predis or with Leonardo, but was perhaps by the same pupil or imitator of the latter master, who executed the copy of the Vierge aux Rochers now in the National Gallery, and the two angels belonging to it, in the possession of Duke Melzi at Milan, now also in the National Gallery.

This was written before the discovery of the documents which show that Ambrogio de Predis was the painter of the two angels and was also associated with Leonardo in executing the commission for the picture of the Virgin of the Rocks now in the National Gallery.

It is quite possible that if he had been in possession of this information Morelli would have regarded de Predis as the painter of the picture in the Ambrosiana. In addition to Bode, whose acceptance of the Leonardo tradition was the occasion of Morelli's pronouncement, the theory of Leonardo's authorship has been accepted by Beltrami, Corrado Ricci, and Sir Herbert Cook, while on the other hand the picture is assigned to de Predis by Seidlitz, Berenson and Venturi. In the absence of some fresh documentary evidence it is likely to remain an open question.

'The standard attained by an Ambrogio de Predis, by a Bernardino de' Conti, nay, even by a Boltraffio,' says Sir Herbert Cook, 'serves to emphasize the unattainable heights reached by Leonardo.' In other words, as he adds, the problem is one of quality, and the touchstone of quality is feeling. It is because I do not find in this picture anything of the quality which is inherent in the few authentic works of Leonardo, the product as they are of infinite labour and thought, that I cannot admit it to be of the same lineage. It lacks altogether their subtilty and infinite grace. It would seem incredible that the hand in its stiff position holding the piece of music with cramped fingers has anything to do with

Leonardo, if we think how he rendered hands not only in the Mona Lisa but in the Louvre Annunciation. It has a far closer counterpart in the de Predis' portrait of Archinto in the National Gallery, and it would be far more probable that de Predis, who had more of the Quattrocento manner, reproduced it in his hands than that Leonardo ever relapsed into it. In the carriage of the head and the treatment of the shadows may be found resemblances with the figure of the Melzi angel playing the tambourine; but as we compare the structure in this portrait with the acknowledged works of de Predis we feel that Sirèn only does the picture justice when he says that de Predis never attained the degree of plastic expressiveness which this portrait exhibits.

We may feel also that the sense of values which the picture creates harmonizes most with the suggestion of Sirèn, which was, he says, concurred in by Sir Charles Holroyd, that the picture should be regarded as a work by Boltraffio, who, as Sirèn remarks, comes much nearer to Leonardo here than in most of his paintings, but whose peculiar characteristics all find expression here. We may notice especially the thick protruding lower eyelids visible also in the two Madonnas by Boltraffio in the Louvre and the National Gallery, and the fact of the eyes being just a little out of drawing.

This attempt to compile an apocrypha following the canon, which although according to the rubric not fit to establish any doctrine is yet 'suitable for example of life and instruction of manners,' might lead to the consideration of other works connected in origin with the period of Leonardo's presence in Verrocchio's studio, of others also which seem in part to reveal the tenets of the earlier school of Milan in process of submergence to Leonardo's teaching, as well as of those others which by whomsoever executed yet owe to him the fact of their primary inspiration. To one of this last class attention has recently been directed by Dr. Emil Möller, who, by his skill in the interpretation of a passage in Leonardo's manuscripts formerly misread by Richter, fur-

nished some time ago what would seem to be conclusive evidence of Leonardo having undertaken in the year 1497 a commission for an altar-piece in the church of S. Francesco at Brescia.

In an article in the *Burlington Magazine* for August 1926 he has attempted to show that the small number of Leonardo's authentic paintings should be increased by the addition of a Madonna and Child in the possession of the Duke of Buccleuch, styled the Madonna with the Yarn Winder, which he connects with the description of a picture by Leonardo given in Fra Pietro da Nuvolaria's letter to Isabella d'Este written in April 1501, and which he concludes is the damaged original upon which Leonardo was then working. That a certain connection exists between the picture and the letter is indisputable. Fra Pietro tells Isabella d'Este in his letter that he has prevailed on Leonardo to resume work on her portrait as soon as he has finished a small picture that he is painting for a certain Robertet, a favourite of the King of France, which 'represents the Madonna seated, seeming as though about to unwind her spindles (come se volesse inaspare fusi), and the Child setting his foot on the basket of spindles (posto il piede nel canestrino dei fusi) has seized the winder and is gazing attentively at the four spokes which are in the form of a cross, and as though desiring this cross he laughs and holds it firm, not wishing to give it up to his Mother who seems to want to take it from him.'

We must assume from the circumstantial nature of this description that the action represented in the picture on which Leonardo was then at work was just as Fra Pietro has described it. In the Duke of Buccleuch's picture, however, there is nothing whatsoever to show either that the Madonna is about to unwind her spindles or that the Child is setting his foot on a basket of spindles. One of the Child's feet is shown resting against his Mother's knee and the other is turned so that the sole is uppermost. The basket of spindles does not occur in the picture. If we suppose it to have dis-

appeared in process of repainting, we must also suppose that the position of the Child's body has been altered, since in its present attitude the foot could not naturally be resting on a basket. Nor does the placid unconcerned expression of the Madonna in the picture at all harmonize with the action indicated by Fra Pietro, in which the Child is said to be holding the winder firmly, not wishing to give it up to his Mother who seems to want to take it from him (e tienla salda non la volendo cedere alla mamma che pare gliela voglia torre). I cannot therefore think that the composition of the Duke of Buccleuch's picture, in which the Madonna is seated on a shelving rock against which the Child, half on her knee, whom she encircles with her left arm, is leaning holding up a distaff, is identical with that described by Fra Pietro, but should regard it as a simplification of the motive, and therefore later in origin. The alternative possible, I admit, though hardly probable is to regard all the intricacy of action referred to by the Carmelite Vicar-General as originating in his fertile imagination, stimulated as it may have been by the influences of the season of Lent, the letter having been written apparently on Good Friday.

It is therefore upon stylistic grounds that any decision as to the authorship of the picture must be based. So far as it is possible to form a judgment from the excellent reproduction which accompanies Dr. Möller's article, the picture would seem to be the work of one of the Milanese assistants of Leonardo whose artistic identity became most completely merged in his, but whose work, rivalling that of his master in technical dexterity and smoothness, lacks altogether his intellectuality and structural power. Perhaps the name of Andrea Solario may be thus associated with the picture, since if the reproduction of it be compared with that of *La Vierge au coussin vert* in the Louvre we find various marked resemblances in the treatment of the hair of the Madonna, parted very high up on the forehead, in the very deep shadows of the corners of the mouth, and the thick heavy eyelids, and

in the thick curls, deep-set eyes and bulging cheeks of the Child. The delicacy of treatment of the head of the Madonna is characteristic of Solario. 'No other painter,' says Morelli, 'approached Leonardo so nearly, or succeeded in treating heads with a like degree of finish.' In the representation of the hand, however, he says Solario was far behind Leonardo, Sodoma, and even Gianpietrino, with which we may compare Dr. Möller's remark that in the Madonna with the Yarn Winder 'the right hand appears heavy.'

If a drawing by Leonardo in red chalk at Windsor which Dr. Möller reproduces be really, as he suggests, a study for this picture – as to which I feel considerable doubt both because the head is turned at a different angle to the body in the drawing but not in the picture and because the type of the dress, and especially the sleeves, point to it being a study for a portrait rather than for a Madonna picture – then the fact of it having been so used would tend to show that the picture was the work of an artist other than Leonardo, on account of the great loss of structural power which it reveals in the treatment of the neck and bust as compared with the firmer, more responsive and plastic modelling of the drawing.

SCULPTURE

THE eulogy of painting among the liberal arts forms a considerable part of the philosophical section of Leonardo's treatise on painting, fragments of which are found in various of his manuscripts as well as in the copy in the Vatican Library edited by Ludwig. Wherever in these passages painting is compared in respect of capacity with the sister arts of poetry and music the standpoint of the writer is uniformly that of the painter, although as regards music there is evidence of his own proficiency both in the manuscripts and in contemporary record. When, however, the argument embraces sculpture in its scope the standpoint changes abruptly and claims equality of experience and attainment: 'as practising myself the art of sculpture no less than that of painting, and doing both the one and the other in the same degree, it seems to me that without suspicion of unfairness I may venture to give an opinion as to which of the two is the more intellectual, and of the greater difficulty and perfection.'

The passage occurs on folio 25r. of Manuscript 2038 of the Bibliothèque Nationale, which consists of sixty-eight pages removed from Manuscript A by Libri, which all formed part of the treatise on painting. A dated reference, tenth of July 1492, in some household accounts occurring on the last page, folio 34v., serves to indicate the time at which the section was written, and it follows therefore that the claim of having engaged as much in sculpture as in painting can only be interpreted to refer to Leonardo's life up to his fortieth year. The title of the passage of which the words form the opening sentence, 'that Sculpture is less intellectual than Painting and lacks many of its natural parts,' of itself suggests the nature of the conclusions, which are in fact uniformly adverse to sculpture. Thus he finds it more dependent on external conditions, e.g. it requires a certain light, that is a light from above, whereas painting carries everywhere with it its light and shade; it owes its importance to

light and shade, but the sculptor is helped by the nature of the relief inherent in sculpture, whereas the painter is free to place his light and shade in the spots where nature would naturally produce it. The sculptor cannot diversify his work by the various colours of objects: painting does not fail to do so in any particular. His lines of perspective do not appear in the least true, whereas those of the painter may seem to extend a hundred miles beyond the picture. Aerial perspective lies altogether outside his scope; and even in the power of resisting time his work is inferior to painting done in enamel colours upon copper covered with white enamel and baked in the fire. If the comparison be made only with panel painting he admits that sculpture is more enduring, but it has no other advantage, painting being more beautiful, more imaginative and more abundant. Other passages which occur only in the Vatican copy of the manuscripts, and of which therefore the exact date of composition is unknown, lay stress on the mechanical aspects of the sculptor's art, the bodily fatigue arising from the labour of striking the marble, and the physical discomfort caused by the dust and chips, the mixture of sweat and dust occurring on the face being described with grim realism, in contrast with which the references to the comfort and *bien-être* of the studio in which the painter works, attended if he desires by musicians and readers, have a somewhat conventional ring; and yet the musicians are testified to by Vasari in his account of the genesis of the Mona Lisa.

In another passage in the same manuscript he offers instances of the power of the painter to visualize various distances with the gradations of colour producing interposition of the air between the objects and the eye, all of which are denied to the sculptor. Lomazzo, in his *Trattato della Pittura*, speaks of having read a book written by Leonardo at the request of Ludovic Sforza in order to determine the question whether painting or sculpture was the more noble, the conclusion arrived at being that the nobility of an art is in

exactly inverse proportion to the amount of bodily fatigue and discomfort which its exercise involves. It may be assumed that all these passages formed part of this treatise, and one of them would seem to be a draft of its final conclusion.

Their tenor hardly seems to do justice to Leonardo's dialectical powers if we compare them with passages in which, in expounding the results of his geological researches, he states the case for an imaginary opponent. Here he would seem by contrast to be less anxious to survey the truth from all sides, and to decry sculpture for what it is not rather than to attempt to estimate its separate and distinctive qualities.

But the passages have a considerable value as biographical documents. They show Leonardo ten years after the commencement of the commission for the Sforza statue profoundly estranged in mind from the calling of the sculptor. The passage claiming equal experience in the practice of the two arts also reinforces the testimony of Vasari as to his activity during the time that he was attending Verrocchio's studio: 'he worked,' he says, 'not only in sculpture, executing in his youth in terra-cotta certain heads of women that are smiling, of which plaster casts are still taken, and likewise heads of children which seem to have come from the hand of a master.' His connection with Verrocchio was at the outset as close as that of any pupil to any master. He was out to learn all that Verrocchio could teach him. In Vasari's life of Verrocchio he speaks of possessing some of his drawings, amongst them being certain female heads 'of which the features, expressions, and arrangement of the hair were constantly imitated for their exceeding beauty by Leonardo da Vinci.' As Mr. Eric Maclagan has shown in the *Burlington Magazine* for September 1921, by a reference to the copy in Berlin by a follower of the Della Robbia of Verrocchio's relief of Darius, the latter was used and improved by Leonardo in his magnificent drawing in silver point of the head of a

warrior in the British Museum. Since both the testimony of records and the evidence of existing works attributed to him go far to show that Verrocchio's personality found freer and more congenial expression in sculpture than in painting, it would seem natural to suppose his influence upon the work of his pupil to have been at least as great in sculpture as in design, and we may expect therefore to find this influence present in any work in sculpture which belongs to Leonardo's earlier period. Some of this is specifically referred to by Vasari, 'certain heads of women smiling and heads of children,' and Lomazzo also mentions the fact of having in his possession a small head of Christ as a child in terra-cotta by Leonardo, which he characterizes as displaying 'the simplicity and innocence of childhood, together with a certain suggestion of wisdom, understanding, and majesty.' From the nature of each description we may infer the presence of traces of that same enhanced desire of expression which separates Leonardo's earlier work in painting from that of his contemporaries. If any of the early work in sculpture be ever hailed from the limbo where perchance it lurks unrecognized, it will be as revealing, however tentatively the incipient upspringings of this desire. It should also show as the seat of its indwelling a type looser of limb, more sinuous, of far greater power of mobility of features than those of his contemporaries – to sum up, the Leonardesque as exemplified in the figure of the angel on the left of Verrocchio's Baptism. – The fact that no existing work of sculpture is attributed by consent to Leonardo places unusual difficulty in the way of such interpretation, for the comparative test is the foundation of connoisseurship. In its absence there can no more be certainty than as Leonardo says there can be where one of the mathematical sciences cannot be applied. Two small pieces of sculpture in the Victoria and Albert Museum at South Kensington seem, however, to possess some measure of these qualities. Eight little panels at Sant' Alvise at Venice Ruskin held to be boyish works by Car-

paccio representing Biblical events, such as the Fall of Jericho and the Meeting of Solomon with the Queen of Sheba, with such naïve simplicity and occasional irrelevance as would seem native to the future painter of the S. Ursula cycle. Ludwig prefers to call them school of Bastiani, but this leaves their extraordinary gift of narrative without any natural sequel. With the very important difference that their execution would not precede but would date from the beginning of the period of his apprenticeship, the two works in South Kensington might be considered as holding a similar position in respect to Leonardo.

In the small terra-cotta bust of S. John the Baptist as a youth, half-length with neck and arms bare and a piece of sheepskin across the breast, we have what is possibly the earliest existing work by Leonardo. The *naïveté* and tentative note show the hand of the beginner, unconscious almost, apparently, of his power, and there is a certain weakness in the modelling of the neck and bust. The mobility of the mouth, the curve of the nostril, the protrusion of the bend of the upper lip, the dimple of the chin, are all reminiscent of Leonardo's drawings. There is also something of the same freedom of line. In the expression we are conscious of the pursuit of some more subtle rendering than is displayed by Verrocchiesque works of greater power of execution. We are carried forward in thought by the suggestion of shadow that plays around the corners of the mouth. The thick clustering curls of the hair are fashioned like those of the angel in the Louvre Annunciation. The structure of the face, with high cheek-bones and softly curving lines, is – as far as the medium allows – that of Leonardo's angel in Verrocchio's Baptism. 'In the expression and look of the figure,' says Carotti, 'in the delicacy of the thick clusters of the hair, in the modelling of the face, in addition to the characteristics of Verrocchio there are visible also those of Leonardo.'

The official description of the terra-cotta statuette known as the Madonna with the Laughing Child records succinctly

the changes of critical opinion: 'sometimes ascribed to Antonio Rossellino or to Desiderio da Settignano, but more probably made in the workshop of Verrocchio, perhaps by the young Leonardo da Vinci.' Carotti assigns it to the latter definitely, and likens the fragrance of the simplicity and happiness of the group with that of the drawing for a Madonna del Gatto in the British Museum. Sirèn characterizes it as the only work executed in Verrocchio's studio during this period in which a pre-eminently Leonardesque character may be discerned, and considers that there is no other sculpture extant revealing so close a connection with the young Leonardo's art. The head of the Child bears so strong a resemblance to that of Verrocchio's Boy with Dolphin that it is hardly possible not to infer a direct connection. In the head of the Madonna, however, bent forward as she watches the transports of the Child and smiling as much as he, there is surely the beginning of another personality. The figure is somewhat more lissom, more rhythmic in its curves than we find in any of Verrocchio's authentic works. The dimpling hollow of the cheek, the curve of the mouth, the hollow beneath the centre of the lower lip, the supple fullness of modelling of the flesh, all have a suggestion of Leonardo. Whereas for the Child the artist had a model which satisfied him, in the Madonna he was attempting to realize his own conception, and therefore it is at once more expressive and more tentative. The drapery bears a resemblance in the broad general lines of its movement to Leonardo's study in the Louvre of the drapery of a seated figure seen in front. It may be his earliest attempt to render statically the folds resting across and falling from the knees of a seated figure. The expression of the Madonna serves to bring to mind Vasari's remark about Leonardo having in his youth executed in terra-cotta certain heads of women smiling.

In a volume entitled *Leonardo da Vinci, Sculptor*, published four years ago, Sir Theodore Cook essayed to prove that a relief in stucco of a Madonna and Child in the posses-

sion of Mr. Dibblee, the Bursar of All Souls', which was removed from Italy in the year 1897, should be regarded on purely stylistic grounds as a work by Leonardo carved in the year 1478, and his conclusions as to its authorship were reinforced by those of Venturi in *L'Arte* for July 1922. The same writer has already earned distinction by his study of spiral formations in nature and art, with special reference to the works of Leonardo, and especially by the manner in which this evidence is used to connect his name with the spiral staircase at Blois. Without in the present instance sharing Sir Theodore Cook's conclusions, one must needs pay tribute to the zeal and enthusiasm with which he has marshalled facts and correlated reliefs in support of his theory. To me, however, the visual impression of the relief itself is so definitely Verrocchiesque as to outweigh this evidence. If the lineaments of the Madonna be compared with those of the marble relief of the Museo Nazionale, which is accepted as Verrocchio's work by Mackowski and also by Venturi, the similarity of type and treatment leads to the conviction that if it cannot be attributed to the master himself it is by some pupil in his studio whose personality was absorbed in that of his master so that he reproduced his type with a fidelity quite alien to Leonardo's nature. Were the ascription admitted we should be faced with the extraordinary fact of Leonardo having made a relief for a member of the famous Florentine family of the Albizzi, of it having been placed in their villa a few miles from Florence, and of this circumstance having entirely escaped the notice of every Florentine art historian.

A sentence in the short life by the Anonimo Gaddiano lifts the curtain upon what would otherwise be an unrecorded chapter of Leonardo's life in Florence, and one in which the prevailing activity would apparently be the study of sculpture: 'He lived when young with Lorenzo de' Medici, Il Magnifico, who made provision for him and employed him upon work in his Garden in the Piazza

di San Marco.' In Vasari's life of the sculptor Torrigiano there is an account of the treasures of classic and Renaissance art accumulated there by the Medici under the care of Bertoldo, and we are told how the Garden served as an Academy for the younger artists of Florence. Verrocchio was employed there by Lorenzo to restore the mutilated figure of a Marsyas, and in this work, which he did to the complete satisfaction of Il Magnifico, he may possibly have been assisted by Leonardo. Whatever work the latter may have done in the employment of Lorenzo has escaped record, but we think of him as passing to and fro amid the collected treasures of art, storing up impressions which in due time yielded a rich harvest. The period of this service, placed by Ravaisson-Mollien in the year 1477, followed immediately after that of his close association with Verrocchio. Thereafter are records of commissions for two altar-pieces, and in the many studies for the Adoration which may be identified with the second of these we may see how some of the motives of later compositions first took shape in the crucible of his mind. A sheet of drawings at Windsor, with a rearing stallion which has been used for one of the horses in the tilting scene in the background of the Adoration of the Magi, contains also studies of heads of horses, head of a lion and of a man, all of which typify the frenzy of combat with something of the dramatic intensity revealed in the Anghiari cartoon and in certain of the studies for the Sforza and Trivulzio statues.

These are not the usual concomitants of altar-pieces. Their presence may in part account for its slow gestation. Studies and picture alike show how deeply the potentialities of equine expression had already stirred his imagination at the time that the Venetians, desiring as Vasari says to do honour to the distinguished valour of Bartolommeo Colleoni, invited Verrocchio to execute an equestrian statue of the commander. Leonardo must have been an interested observer of the progress of Verrocchio's conception up to the time of the

model being sent to Venice, which took place in the year 1481. Was this the spark that fired the train? Ever since Galeazzo Maria Sforza, dissolute but art-loving, had formed the project of erecting an equestrian statue to the memory of the great condottiere Francesco Sforza the matter had been in abeyance. Offered originally to the Lombard sculptors, the Mantegazza, who had shrunk from its magnitude, it had been revived by Ludovic Sforza. Vasari speaks of two drawings and a model made for it by Antonio Pollaiuolo, one of the former being now at Munich. The project must have been known in Florence, and the appeal of it to Leonardo would be great, as affording an opportunity similar to that possessed by Verrocchio of testing his powers as a sculptor. The troubled political conditions of Milan furnish, however, a sufficient reason why the first nine clauses of the famous letter to Ludovic Sforza should deal with inventions for use in land and sea warfare, all of which are treated of in technical detail in various of his manuscripts. The offer of other services prefaced by the words 'in time of peace' comprises architecture and canalization, sculpture in marble, bronze or clay, painting: 'moreover,' he continues, 'I would undertake the commission of the bronze Horse, which shall endue with immortal glory and eternal honour the auspicious memory of your father and of the illustrious house of Sforza.' There is a certain dramatic fitness in the fact of these words being used by Leonardo about the commission, which, judging either by the time during which he was engaged upon it or the impression that it made upon his contemporaries, ranks first among his artistic works. Sabba da Castiglione, a contemporary diarist who witnessed the destruction of the model, speaks of his having spent sixteen continuous years upon the commission, but how far from literal was the interpretation of this sentence in the mind of the writer may be seen by the fact that in the passage which precedes it he states that few other works in painting by Leonardo were to be seen in Milan besides the Last Supper be-

cause 'he gave himself entirely to geometry, architecture and anatomy.' Intermittent as the work on the commission for the statue undoubtedly was, a reference to it in a fragment of a letter by Leonardo (Codice Atlantico, folio 323v.), in which he speaks of having been invited from Florence to do the work, points to the preparations for it having been commenced immediately after his arrival in Milan. How wide was their extent is shown by the fact of their having included the writing of a treatise on the anatomy of the horse of which portions exist principally at Windsor, and studies and notes of the equestrian statues of classical art. Especially he studied that antique equestrian statue of gilded bronze known as the statue of Regisole which had been brought by the Goths from Ravenna to Cremona, where, according to the testimony of Antonio Campo, the historian of Cremona, a stallion being led near to it thought it to be alive, and which from Cremona was taken to Pavia, where it stood in front of the Cathedral until the year 1796, when it was destroyed by fanatics.

The following notes on folio 147r. of the Codice Atlantico may be interpreted as having reference to it: 'In that at Pavia the movement is more to be admired than anything else. The imitation of antique work is better than that of modern things. You cannot have both beauty and utility as is seen in fortresses and in men. The trot is almost the nature of the free horse. Where natural vivacity is lacking it must be supplied by art.' In the widest study on lines such as these, in researches in casting, in measurements and in the construction of moulds, in the intervals of time spent on altar-pieces and portraits and other undertakings, the years drifted by. The statue still seemed as far off as ever: in July 1489 the Florentine agent at Milan, Pietro Alamanni, wrote to Lorenzo de' Medici to ask him in Ludovic's name to send another master to take Leonardo's place in work upon the statue as he had not much confidence in his capacity to complete it. What, if any, were the consequences of this letter in

Florence is unknown. Müller-Walde has made the very interesting suggestion that the model and drawings for the statue by Antonio del Pollaiuolo to which Vasari refers should be regarded as a result of it. It may also have been a cause why in the following year Leonardo's preparations reached a more active stage. A note on folio 15v. of Manuscript C of the Institut, which treats of 'light and shade,' states, 'on the twenty-third day of April 1490 I commenced this book and recommenced the horse.' From this time forward it may be assumed that Leonardo's work upon the commission was much more continuous than it had been before, since on the occasion of the ceremonies held in Milan in November 1493, to celebrate the marriage of the Emperor Maximilian and Bianca Maria Sforza, the clay model of the statue was erected under a triumphal arch in the piazza in front of the Castle.

That the model then exhibited contained the figure of the Duke Francesco as well as of the horse is clearly to be inferred from the lines of Pietro Lazzarone, *De Nuptiis Imperatorie Maiestatis*:

> 'Fronte stabat prima, quem totus noverat orbis
> Sfortiae Franciscus Ligurum dominator et altae
> Insubriae, portatus equo.'

It was in the course of the year before the exhibition of the clay model, when the work was probably already in an advanced state, that he made the comparison of sculpture with painting in which the potentialities of the latter were relatively so enhanced, and wrote in a mood of depression, 'sculpture is not a science, but a mechanical art, because it causes the brow of the artist who practises it to sweat, and wearies his body.'

That the execution of the statue never proceeded beyond the stage of the clay model is definitely stated by Vasari, and only less definitely in the life by Paolo Giovio. The Anon-

imo Gaddiano records an incident which occurred after Leonardo's return to Florence in which the fact was specifically referred to by Michelangelo in taunting Leonardo with his inability to cast the horse in bronze.

The tragedy of the statue began very soon after the erection of the model. The size of the work being what it was, says Vasari, insuperable difficulties presented themselves when it came to be cast, since the casting could not be effected in one piece. But as his letters show, it was not so much technical as political difficulties which defeated Leonardo. His friend Luca Pacioli, in the preface to his *De Divina Proportione*, gives the exact dimensions of the statue as twelve braccia, that is about twenty-six feet in height, and to weigh when cast in bronze about two hundred thousand pounds. Vasari in his life of Giuliano da San Gallo says that when he was in Milan he was consulted by Leonardo with regard to the casting and gave him valuable advice. In a passage in the Trivulzio Manuscript, quoted by Richter (737), Leonardo states that in order to cast a hundred thousand pounds of metal it is necessary to use two furnaces with two thousand pounds in each, or as much as three thousand pounds at most.

The calculation is difficult to follow, perhaps some digits have been omitted, but it shows at any rate that Leonardo had no very fixed intention to cast the statue in one piece. The technical difficulties may have delayed the execution of the project, but the reason of its abandonment was probably that Il Moro had completely drained his exchequer by subsidies to his allies and imposing ceremonies at Milan of which that on the occasion of the marriage of the Emperor Maximilian with Bianca Maria Sforza was the last and greatest. As a consequence he found himself entirely without funds sufficient to provide the amount of bronze necessary for the casting of so great a statue. During the last years of his tenure of the duchy he had not even money for the salaries of his servants. In the fragments of a letter to the

Duke (Codice Atlantico, 335v.), written at about the end of the year 1497, Leonardo speaks of his salary as being two years in arrears, and of his having two skilled assistants to pay, and of his time consequently being taken up with gaining a living, and says: 'Of the horse I will say nothing, because I know the times.' Within two years of the probable date of this letter Ludovic Sforza was a fugitive in Innsbruck, Leonardo had left Milan for Venice, and the clay model had served as a target for the arrows of Gascon bowmen.

The general tenor of the passages quoted from the *Treatise on Painting*, in which Leonardo contrasted sculpture with painting ten years after the inception of the Sforza statue, reveals an estrangement which, if it represents the definite outlook of his mind, betokens the approaching end of his activity in the art which he deemed meaner and less intellectual. There is in fact no evidence in contemporary record of subsequent work in sculpture, with the one important exception that on folio 179v. of the Codice Atlantico there is a detailed estimate drawn up by Leonardo for a monument to Messer Giovanni Jacomo Trivulzio, who, once a captain in the Milanese armies, had been passed over for preferment by Ludovic, had subsequently espoused the French side and become a bitter enemy of the Sforzas. As such he returned in triumph as commander-in-chief during the French occupation of Milan, and it must have been then, with some thought perhaps of gaining for himself some of the enduring fame which the Sforza statue had been intended to confer upon the founder of the house, that he conceived the idea of getting Leonardo to execute an equestrian statue as part of a sepulchral monument.

The statement in the Codice Atlantico (folio 179v.) is remarkable for its great precision of detail. He commences with an estimate of the cost of making and of the materials for the horse, thus:

'a courser life size with rider requires for cost of metal	ducats	500
cost of ironwork inside model, charcoal, wood, pit for casting, and for binding the model and including the furnace where it is cast	ducats	200
for making model in clay and then in wax	ducats	432
for labourers for polishing it when cast	ducats	450
total	ducats	1,582

Detailed estimates follow of the cost of the marble for the various parts of the sepulchral monument with their measurements, and also of the amount of work necessary for each, amounting in the one case to 389 ducats, in the other he 1,075 ducats. Eight figures round the base on which our horse stands at twenty-five ducats each, eight festoons, four at fifteen, four at eight ducats, the same number of fluted columns, bases and pedestals, six square blocks with figures and trophies, six harpies with candelabra, measurements and prices of cornice, frieze architrave, rosettes for soffit, and for carving the moulding of the stone under the figure of the deceased, and for the statue of the deceased 'to do it well,' which is estimated at a hundred ducats out of a sum total of 3,046.

The exactness of the specifications has no parallel in any of the other references to artistic commissions in Leonardo's writings. These have all in contrast something of the vagueness and hesitance of creative thought projecting itself into the unknown. Here he is meticulous and entirely taken up with the details of the account. There is no reference in any contemporary record to such a monument ever having existed, or to Leonardo ever having been engaged upon it, and critics might conceivably have been disposed to regard the whole project of a monument to Trivulzio as having begun and ended as far as Leonardo was concerned with this detailed estimate, if it were not that some of the details

specified in the monument, particularly the attendant figures and columns of the base, have fairly close parallels in Leonardo's drawings. On the strength in part of these resemblances Müller-Walde attempts to divide the various studies by Leonardo for an equestrian statue into four groups as embodying an earlier and a later conception for the Sforza monument and also an earlier and later conception for the Trivulzio monument, in each of the two earlier conceptions the horse being represented as galloping over a fallen soldier, and in the later conceptions as walking. The amount of contemporary evidence as to the time and extent of Leonardo's work upon the Sforza statue is, however, so great as compared with this one sheet in the Codice Atlantico, which only purports to be an estimate, that it is far from harmonizing with this division of the material.

Although it is impossible to disregard altogether the resemblances which exist between various drawings and the detailed estimate of the Trivulzio monument, it is possible to account for them by supposing Leonardo to have derived the idea of some of his details from his own studies made originally for the Sforza statue, which might explain the fact of the details being already co-ordinated in his mind. This is apparently the opinion of Professor Meller, who in the course of his brilliant and, I think, wellnigh convincing attempt in the Prussian *Jahrbuch* (1916) to identify a bronze statuette at Buda-Pest as a cast from a model made by Leonardo as a study for the Trivulzio monument, maintains that a small sketch on a sheet at Windsor should be looked upon as a study for the Trivulzio monument, although on the same sheet on which it occurs there are three other studies which he regards as studies for the Sforza statue.

In view of all the evidence it seems natural to assume that by far the greater part of the drawings were done as a preparation for the Sforza statue. As Müller-Walde has shown, they fall into two main groups, the first idea of the composition being that of the horse galloping over a prostrate foe.

The fact that in Antonio del Pollaiuolo's study for the Sforza statue the horse is also in this position may point perhaps to it having been suggested by Ludovic Sforza. The second conception in which the horse is walking may well owe something to Leonardo's study of the statue of Regisole; it may have been preferred on statical grounds after trial of the former position had revealed its peculiar difficulties; the note on the cover of Manuscript C of the Institut of his having recommenced the horse on the twenty-third day of April 1490 may refer to the date of the final adoption of this form of composition. Since, however, the model of the Sforza statue has perished and the direct evidence about the Trivulzio monument amounts only to an estimate, there is necessarily a strong note of conjecture attaching to any conclusions which may be come to concerning them.

The many preparatory studies at Windsor reveal the full maturity of his power. In some flame-like swiftness of movement takes its simple inevitable course, some show elemental passion in conflict, some curve and dignity of line in statuesque immobility, in some the rounded form is so wrought as by the impress of nature that they serve to show why he found the plastic medium more stubborn and less responsive in registering the moods of thought.

The words that Pater applied to the Renaissance, 'in many things great rather by what it designed or aspired to do than by what it actually achieved' may recur to mind as we study the drawings for the statue, which in their infinite variety of expression preserve the characteristics of Leonardo's most deeply considered and most sustained work, and which in their excellence are of themselves sufficient to justify his claim 'as practising the art of sculpture no less than that of painting and doing both one and the other in the same degree.'

The list of works in sculpture assigned to Leonardo by early authorities is completed by the mention of a small

model of the Sforza statue in wax, considered perfect, which according to Vasari was lost when the French entered Milan, and also of a bas-relief of a horse in plaster, which according to Lomazzo was in the possession of Leone, a sculptor of Arezzo, father of that Pompeo Leoni who formed the Codice Atlantico out of Leonardo's manuscripts. Of its subsequent history nothing is known.

He is also said by Vasari to have assisted Rustici with advice in the composition of the three figures which are over the north door of the Florentine baptistery, his influence being perhaps most clearly visible in the structure of the cranium of the bald head of the Levite.

Although the silence of contemporary record seems to show that Leonardo hardly practised the art of sculpture subsequently to the Sforza period, it may be that earlier work, possibly also some of a later period, still lurks unrecognized awaiting a finer connoisseurship. The task, if not rendered impossible, has at any rate its difficulties enormously increased by the lack of authentic examples. The comparative test is lacking, and it is the first essential of connoisseurship. Evidence of style is vitiated by the difficulty of transmission from painting to sculpture. The fact that the determination must be largely subjective makes it improbable that any conclusion will command a consensus of opinion. The records of criticism tend directly to confirm this. The wax bust at Lille has now no advocate. The modernity of that at Berlin must be admitted on sartorial evidence, although the subtilty of the reconstruction which might justify another inference shows how full of pitfalls is the path of the connoisseur. The bas-relief of Scipio in the Louvre, the relief of two youths bearing a shield in the Palazzo Communale at Pistoia, are examples of work marked with his influence which has been connected with his name. The weaker modelling of the former by contrast with the finely conceived head of a condottiere by Leonardo in the British Museum would seem to relegate it to Verrocchio's studio. The relief

at Pistoia had probably the same origin. The use of a drawing by Leonardo may have been the origin of the Leonardesque type of the faces and limbs.

Bode's ascription to Leonardo of the small terra-cotta relief known as 'Discord' at South Kensington, and the small bronze reliefs of the Scourging of Christ at Perugia, and the Deposition in the Carmine at Venice, finds few supporters. Of the Discord it may be said that had Leonardo been responsible for the action the strain of it would not have been everywhere so palpable. The muscular effects and sinuosity of limbs are exaggerated to an extent never seen in Leonardo's drawings, and the crowded yet featureless architectural background is not at all in his manner. This also applies to the background of 'the Scourging.' Schubring in his book on *Sienese Sculpture* restores all these reliefs to Francesco di Giorgio, and they seem to possess all his characteristics of fineness of detail and careful finish as defined by Vasari. Francesco di Giorgio, who accompanied Leonardo to Pavia in 1490 to advise on the construction of the cathedral, had something of his breadth of interests, and worked as architect, engineer and painter, as well as in sculpture, in which art he excelled. He was the favourite artist of Federigo, Duke of Urbino, whose portrait he has introduced in the foremost of the two figures in profile on the right of the Deposition.

Perhaps the most recent ascription is that of a terra-cotta group of a horseman and foot-soldiers in combat in the Camondo Collection in the Louvre, and two others similar in subject in a private collection in Florence by Mr. Raymond Stites, which appeared in an American University publication (*Art Studies*, 1926).

The action of the groups typify combat on the lines indicated by Leonardo in his passage on 'the way to represent a battle,' and the dramatic intensity of the action recalls the drawings for the heads of combatants in the Anghiari composition. The accompanying photographs hardly help to an

opinion as to whether this general similarity of intention finds such technical expression as should justify the attempted ascription, or whether, as seems on the whole more probable, the resemblance should be attributed to the fact that for so long as the completed portions of the Anghiari picture and of Michelangelo's 'Bathers' existed on the wall of the Great Council Chamber they were, in the words of Benvenuto Cellini, 'the school of the world,' and as such afforded opportunities to others to catch something of the master's power.

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